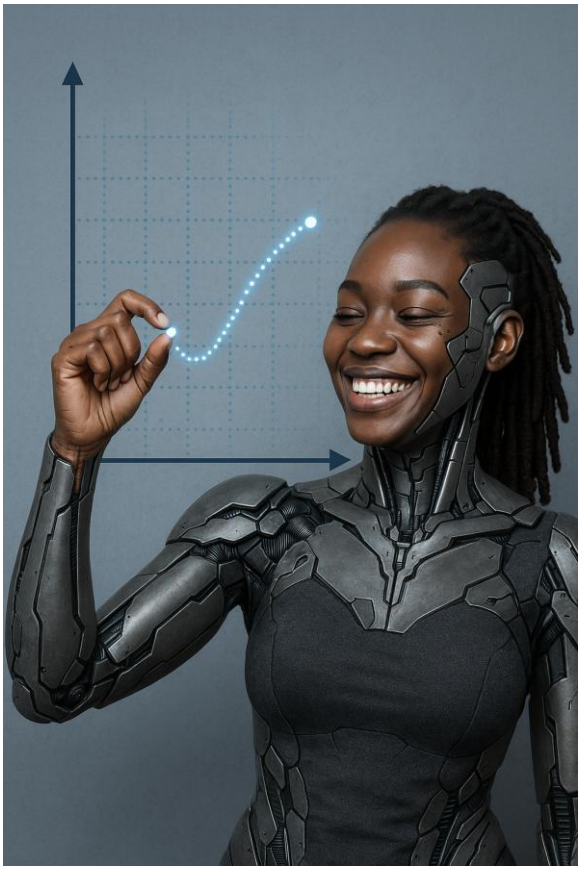
Introduction to Impossible Probability,

Statistics of Probability or

Probabilistic Statistics. VOL 6

Dr Rubén García Pedraza



Introduction to Impossible Probability,

Statistics of Probability or Probabilistic Statistics

Dr Rubén García Pedraza

2015, Revised Edition, for Print and eBook Version.

Translated into English in September 2025,

using ChatGPT, keeping the translation as faithful as possible to the original

Preliminary Words [2015 edition]

Introduction to Impossible Probability, Statistics of Probability or Probabilistic Statistics is one of those works in which a deep bond between mathematics and philosophy can be found.

It always asks about the ultimate purpose of science, wrapped in a veil of uncertainty and relativity.

There is always a halo of indeterminism, since in the end it is chance itself—the random variations of what we call reality, although we do not quite know what it is—that becomes the cause of causes.

From an interpretation not devoid of a certain nihilism, it offers a different vision of mathematics applied to statistics and probability.

The work is organized into a series of sections whose exposition unfolds in a continuous manner, each section and each paragraph being numbered in an ordered numerical sequence, in a way that facilitates reading.

Introduction to Impossible Probability first appeared in December 2011, in a limited edition of which a few copies still remain. It was later modified into a new eBook version that appeared in January 2013, whose first revision dates from January 2014. The version now presented is the latest update, based on contributions from January 2015.

To all readers, many thanks, and enjoy,
Rubén García Pedraza

Preliminary Words to the English Translation

The work presented here, *Introduction to Impossible Probability*, is essential for understanding the original meaning of the Global Artificial Intelligence. Its origins can be traced back to my writings in 2002 on Astro-ecology, the science that understands the cosmos as a single environment that must be studied from a unified, single science. In essence, this is what the Global Artificial Intelligence seeks to achieve. At the same time, in 2002 I developed the formulations of Impossible Probability, beginning in the early hours of September 11, 2001 with the *Impact of the Defect*, which was later expanded into the *Second Method* on October 16, 2002.

In essence, the entire original philosophy is based on the Cartesian idea of the necessity of a margin of doubt in any scientific proposition. This Cartesian margin of doubt would later, in the application of Karl Popper's falsificationism to inferential statistics, be understood as *critical reason*, the necessary and acceptable margin of error in any provisionally true proposition.

Impossible Probability maintains and deepens the Cartesian and Popperian rationalist tradition, enriching it with new philosophical contributions and some mathematical formulations. It rests on the understanding that the necessity of a margin of doubt in the existence of every provisional truth stems from the human limitation of being incapable of accessing the noumenon of things. It is this a priori limitation—the metaphysical limitation of the human condition—that requires humans to accept errors. Yet this does not mean that the noumenon cannot be known by other means. For this reason, in *Impossible Probability* we propose the construction of the Global Artificial Intelligence: a machine capable of making real the dream of a unified science, a single science that may lead us to the reason for all things. The creation of a global matrix, which may ultimately be resolved in a single equation, will provide the equation that solves the matrix, the very reason for everything.

Due to the special conditions in which I find myself—explained in other documents available on Internet Archive and Amazon—I am compelled to publish as quickly as I translate. For this reason, the English version of *Introduction to Impossible Probability* will be released in volumes as the translation progresses.

September 1, 2025, London, Leytonstone, 18:32

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“What did you do with the other guys

Did people brush their teeth

In the concentration camp”

Ruben Garcia Pedraza

Poem “*Mr Saddle”*

At Stratford Library Poetry Club

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12. The Rational Critique of Raw Scores or Frequencies

12.1. Introduction to the Rational Critique of Raw Scores or Frequencies

12.1.1. *Impossible Probability* is a Second Method in the study of statistics, founded on the statistics of probability, or probabilistic statistics—the study of what happens in chance and history, in space-time. In all cases *Impossible Probability* is a philosophical synthesis that applies the method of the syllogism of tendency, a mathematical dialectical logic.

12.1.2. The Second Method of statistics, the statistics of *Impossible Probability*, began in the spring of 2001. From the very beginning the object of study had to be probabilities, so that in the developments of September 11, 2001 (*the Impact of the Defect*), and October 16, 2002 (the first exposition of the empirical and theoretical probability model), its origin is found in that initial idea from the spring of 2001: to explain the logic of probability.

12.1.3. The logic of dialectics is grounded in the syllogism, among whose forerunners we may highlight Socrates, Plato, and Aristotle, and especially the historical sequencing of Hegel between the *universal, particular, and singular* [at some point this is reflected in GAI through the distinction of the global program, specific programs, and particular programs, with the difference that in GAI the particular level is the singular level in Hegel, and the specific programs are the particular level in Hegel, in any case Specific Ais can be transformed into particular programs, in the end, this is Hegel. In GAI the singular level is the robotic devices]. In the maieutic method, the dialectic of ideas is preceded by irony, the recognition of ignorance—"I only know that I know nothing"—as the genesis of the questions for logical debate on the syllogism. Plato, in

The Republic, esteems geometry, and mathematics in general, as the propaedeutic of dialectics.

12.1.4. Logic has in the classical syllogism its historical principle, and in Hegel's dialectics its most immediate principle. The dialectical logic of the probable is the logic of the inevitable: all that is possible is inevitable. In *Impossible Probability*, however, the inevitability of the possible depends on the availability of rational or necessary time, sufficient or infinite. Time will be rational insofar as it is sufficiently necessary time, and time may be infinite insofar as the model can include the necessary hypothesis of infinite time. If we have only limited time, this limited time may be less than sufficient time; if we lack guarantees that the difference between limited time and sufficient time is zero or positive, then it is possible that limited time, being less than sufficient, is insufficient to make the possible real. In any case, any sufficient time will always be less than infinite time. Thus, having sufficient time—whether in limited time equal to or greater than sufficient time, or in infinite time—the possible will be real. For this reason, the inevitability of the possible depends on the availability of sufficient or infinite time.

12.1.5. *Impossible Probability* gathers within the syllogism the entire legacy of the dialectical idealism of Socrates and Plato, the empiricism of Aristotle, and the dialectical idealism of Hegel.

12.1.6. *Impossible Probability* also incorporates the legacy of dialectical materialism by criticizing the ideological factor in science. To think that science lacks ideological value is to ignore that ideological beliefs—whether religious, political, or economic—permeate the thought of the scientist. To think that the theories of Einstein or Heisenberg lack ideological values is to fail to understand the role that religion played for Einstein in physics, or the way in which Heisenberg's idealism influenced his work.

12.1.7. *Impossible Probability* is thus dialectical logic, a synthesis of critical rationalism, positivism, and dialectics; a dialectical synthesis inasmuch as it unites the dialectical idealism from Plato to Hegel with the dialectical materialism of Marx and Engels.

12.1.8. In *Impossible Probability* dialectical materialism is present insofar as science must understand the ideological variable. A defining element of dialectical materialism

is the ideological critique of reality: it is in moral struggle that each ideology defends a different moral and scientific model, with each scientific model striving to become the paradigm—whether of a science or of science itself.

12.1.9. In the mathematical synthesis that *Impossible Probability* makes between dialectical idealism and dialectical materialism, the concept of the possible and the inevitable is transformed. If in Hegel's philosophy the possible is inevitable in itself, in *Impossible Probability* inevitability depends on the space-time dimension, the *horizon of possible occurrences*: only that which happens within sufficient or infinite time is inevitable. Time is sufficient whenever the time available is equal to or greater than sufficient time for the possibility to be real; time is infinite insofar as any infinite time includes any sufficient time.

12.1.10. *Impossible Probability* is the logical synthesis of positivism, founded by Auguste Comte, and critical rationalism, founded by Kant. *Impossible Probability* and positivism are both grounded in the need for isomorphism, the basis of the scientific method and the *unification of science or the sciences* [in GAI-GPS].

12.1.11. *Impossible Probability* is also founded in critical rationalism, insofar as it establishes the rational meaning of empirical hypotheses, through the rational critique of empirical tests, of phenomena.

12.1.12. If an empirical hypothesis is accepted within a margin of uncertainty, then propositional coherence is accepted within a margin of possible incoherence. This means accepting truth within a margin of empirical skepticism or rational doubt, and accepting truth within the margin of moral responsibility that truth implies. *Impossible Probability*, as critical reason, is grounded in the legacy of empiricism and rationalism, with Hume and Descartes as its highest exponents.

12.1.13. *Impossible Probability* is a synthesis that incorporates the main philosophical influences and confluences of idealism, empiricism, rationalism, critical rationalism, positivism, and dialectical materialism, visible from the *Impact of the Defect* to the Second Method and Effective Distribution, in the study of what happens in the chance of history.

12.1.14. Insofar as probability theory is the foundation of *Impossible Probability*, the statistics of probability is transformed into a synthetic Second Method for the study of empirical, material reality, through rational critique.

12.1.15. In the rational critique of tendency, *Impossible Probability* develops different equations and statistical tests—normal Bias Level, normal Similarity Level, Validity, Significance, Critical Proportions, and Critique of Probabilities. These equations and statistical tests, created within the theory of probabilistic statistics, can be adapted to the rational critique of raw scores or frequencies.

12.1.16. To apply rational critique in the study of raw scores or frequencies, it is first essential to know the statistics of maximum dispersion in raw scores or frequencies.

12.1.17. The main difference between rational critique in the Second Method (rational critique of statistical probabilities) and the practical applications that rational critique can make in the First Method (raw scores or frequencies) is that in the Second Method the statistics of maximum theoretical dispersion can be established *a priori* according to the sample size, whereas in the First Method, in raw scores or frequencies, every value of maximum theoretical dispersion is *a posteriori*.

12.1.18. The main advantage of the Second Method, probabilistic statistics, is that by knowing the magnitude of *N* one can know *a priori* the theoretical statistics and the maximum theoretical dispersion.

12.1.19. In probabilistic statistics, the Second Method, by knowing *N*, one can know the individual or sample theoretical statistics. The reciprocal of *N* is the arithmetic mean and the theoretical probability of random occurrence under equality of opportunity, in any universe. Maximum Possible Theoretical Bias equals one minus the reciprocal of *N*. Maximum Possible Negative Bias equals the absolute reciprocal of *N*. Maximum Possible Theoretical Mean Deviation equals the average of the product of twice the difference between one and the reciprocal of *N*. Maximum Possible Theoretical Variance equals the average of the sum of the square of Maximum Possible Theoretical Bias plus the product of the square of the reciprocal of *N* times (*N* – 1). Maximum Possible Theoretical Standard Deviation equals the square root of the Maximum Possible Theoretical Variance.

12.1.20. In statistics of raw scores or frequencies, theoretical statistics or maximum dispersion are only known *a posteriori*, once the arithmetic mean of the raw scores or frequencies has been calculated. The Second Method offers more advantages because of the multifunctionality of theoretical statistics and their possible *a priori* knowledge, once the scientific policy accepts the sample as given. The greatest and principal difference between the Second Method and statistics of raw scores or frequencies, the First Method, is that in the First Method the arithmetic mean is a value of empirical central tendency.

12.1.21. Since one of the objectives of *Introduction to Impossible Probability* is to disseminate it as widely as possible by adapting it to the First Method, classical or conventional statistics based on raw scores or frequencies, statistics of maximum dispersion in raw scores or frequencies will be presented in order to adapt the Second Method of *Impossible Probability* to raw scores or frequencies.

12.1.22. The first way of adapting the Second Method to the First Method, traditional statistics, will be to maintain within the statistics of raw scores or frequencies the concept of differential score proper to the First Method, traditional statistics. Differential score equals raw score or frequency minus arithmetic mean:

$$\text{Differential score} = x_i - \bar{x}$$

where

x_i = raw score or frequency of subject or option

$\bar{x} = \sum x_i : N$ = arithmetic mean of raw scores or frequencies

12.1.23. For the rational critique of raw scores or frequencies, the statistical tests for equality of opportunity, positive and negative bias will be presented, studying positive bias under the hypothesis that only one subject or option were ideal. Reserved for the

end is the critique of raw scores or frequencies under conditions of subset omega within *N*, where the ideal subjects or options are more than one and fewer than *N*.

12.2. Statistics of Maximum Dispersion in Raw Scores or Frequencies

12.2.1. Statistics of maximum individual dispersion: the maximum values the differential score can take

12.2.1.1. Maximum Possible Theoretical Differential Score

12.2.1.1.1. The *Maximum Possible Theoretical Differential Score*, applied to the First Method, is what in the Second Method is known as the *Maximum Possible Theoretical Bias*.

12.2.1.1.2. In the Second Method, the *Maximum Possible Theoretical Bias* is equal to one minus the reciprocal of N, based on the question of what the maximum normal Bias Level would be—answered quickly: the maximum possible Bias Level is the difference between one (the *Maximum Possible Empirical Probability*) and the reciprocal of N.

12.2.1.1.3. In raw scores or frequencies, the Bias Level is the *differential score*. The maximum possible differential score occurs when the entire sample except one subject or option has raw score zero or frequency zero, with only one subject or option having a raw score other than zero or a frequency other than zero.

12.2.1.1.4. If, in a sample of raw scores or frequencies, the entire sample except a single subject or option has raw scores or frequencies of zero, the sum of the raw scores or frequencies will be equal to the raw score or frequency of that single subject or option that is non-zero. Therefore, the *Maximum Possible Raw Score or Frequency* is precisely the sum of raw scores or frequencies, and the *Minimum Possible Raw Score or Frequency* is a raw score or frequency equal to zero.

$$\text{Maximum Possible Raw Score or Frequency} = \sum x_i$$

$$\text{Minimum Possible Raw Score or Frequency} = 0$$

12.2.1.1.5. In democratic elections, several candidates run; each candidate will want to have all the votes and for competitors to have none. The objective of each candidate is to be the only political subject or the only political option whose vote frequency is non-zero.

12.2.1.1.6. Suppose we conduct a survey on attitudes toward the environment. Ideally, of all possible options, the only non-zero option would be the ideal option—the ecological option—while all other non-ideal options would have zero frequency.

12.2.1.1.7. If in a dataset the entire sample has raw score or frequency zero except for a single subject or option that is non-zero, the maximum differential score is that of this single subject or option. Then the sum of raw scores or frequencies equals that unique non-zero raw score or frequency; the differential score of that unique non-zero subject or option equals the difference between the sum of raw scores or frequencies (which is its own raw score or frequency) and the arithmetic mean, where the arithmetic mean is its own raw score or frequency divided by N. Therefore, the *Maximum Possible Theoretical Differential Score* equals the difference between the sum of raw scores or frequencies and the arithmetic mean:

$$\text{Maximum Possible Theoretical Differential Score} = \sum x_i - \bar{x}$$

12.2.1.2. Maximum Possible Negative Differential Score

12.2.1.2.1. If the differential score is raw score or frequency minus the arithmetic mean, the maximum negative differential score must correspond to a raw score or frequency equal to zero.

12.2.1.2.2. If a raw score or frequency equals zero, then zero minus the arithmetic mean equals minus the arithmetic mean; that is, minus the arithmetic mean is the largest negative value possible for the differential score.

12.2.1.2.3. In absolute terms, the *Maximum Possible Negative Differential Score* equals the arithmetic mean.

$$\text{Maximum Possible Negative Differential Score} = |0 - \bar{x}| = |-\bar{x}| = \bar{x}$$

12.2.1.2.4. If absolutely the arithmetic mean equals the *Maximum Possible Negative Differential Score*, and in a sample all subjects or options except one have raw score or frequency zero, then by simple natural goodness the product of the arithmetic mean by N−1 must be equal to the *Maximum Possible Theoretical Differential Score*:

$$\text{Maximum Possible Theoretical Differential Score} = \bar{x}\,(N-1) = \sum x_i - \bar{x}$$

12.2.1.3. Maximum Possible Empirical Differential Score

12.2.1.3.1. If in the Second Method the *Total Bias* equals the sum of the absolute values of the Bias Levels, then the *Total of Differential Scores* equals the sum of the absolute values of the differential scores:

$$\text{Total of Differential Scores} = \sum |x_i - \bar{x}|$$

12.2.1.3.2. And if in the Second Method the *Maximum Possible Empirical Bias* equals half the Total Bias, then the *Maximum Possible Empirical Differential Score* equals half the Total of Differential Scores:

$$\text{Maximum Possible Empirical Differential Score} = \sum |\, x_i - \bar{x} \,| \;:\; 2$$

12.2.1.4. Maximum Possible Empirical Squared Differential Score

12.2.1.4.1. Since in traditional statistics it is usually preferred to neutralize the sign of differentials by squaring them, the sum of squared differentials is the *Total of Squared Differential Scores*:

$$\text{Total of Squared Differential Scores} = \sum (x_i - \bar{x})^2$$

12.2.1.4.2. Then, dividing the Total of Squared Differential Scores by two yields the *Maximum Possible Empirical Squared Differential Score*:

$$\text{Maximum Possible Empirical Squared Differential Score} = \sum (x_i - \bar{x})^2 \;:\; 2$$

12.2.1.5. Maximum Possible Empirical Typical (Standardized) Differential Score

12.2.1.5.1. Since in traditional statistics the Standard Deviation is the square root of the Variance, and the Variance is the mean of the squared differential scores, the *Maximum Possible Empirical Typical Differential Score* must be the square root of the *Maximum Possible Empirical Squared Differential Score*:

$$\text{Maximum Possible Empirical Typical Differential Score} = \sqrt{\sum (x_i - \bar{x})^2 \ : \ 2}$$

12.2.2. Statistics of maximum sample dispersion: maximum values that the central-tendency statistics of the differential score can take

12.2.2.1. *Maximum Mean Deviation* of raw scores or frequencies. If we know the *Maximum Possible Theoretical Differential Score*, then the *Maximum Mean Deviation* of raw scores or frequencies is the average of twice the *Maximum Possible Theoretical Differential Score*:

$$\text{Maximum Mean Deviation} = \frac{\left(\sum x_i - \bar{x}\right) \cdot 2}{N}$$

12.2.2.2. *Maximum Variance* of raw scores or frequencies equals the average of the sum of the square of the *Maximum Possible Theoretical Differential Score* plus the product of the mean squared by N−1:

$$\text{Maximum Variance} = \frac{\left(\sum x_i - \bar{x}\right)^2 + \left(\bar{x}^2 \cdot (N-1)\right)}{N}$$

12.2.2.3. Maximum Standard Deviation of Raw Scores or Frequencies

The *Maximum Standard Deviation* of raw scores or frequencies is the square root of the *Maximum Variance*:

$$\text{Maximum Standard Deviation} = \sqrt{\{(\sum x_i - \bar{x})^2 + [\bar{x}^2 \cdot (N-1)]\} : N}$$

12.2.2.4. Intermediate Deviation

The *Intermediate Deviation* is obtained by dividing by two the difference between the maximum raw score or frequency and the minimum raw score or frequency. In two-option models, the Intermediate Deviation will be identical to the Mean or Standard Deviation .

$$\text{Intermediate Deviation} = \frac{x_i^{(+)} - x_i^{(-)}}{2}$$

where:

- $x_i^{(+)}$ = maximum raw score or frequency
- $x_i^{(-)}$ = minimum raw score or frequency

12.3. The Rational Critique of the Behavior of Raw Scores or Frequencies

12.3.1. Once the statistics of maximum dispersion in raw scores or frequencies are explained, we have the maximum tendencies upon which to calculate the critical values. The critical value will be symbolized by “xc”.

12.3.2. Since in the Second Method the critical probability is designated by the symbol “p(xc)”, in the First Method the symbol “xc” will designate the *critical score* or *critical frequency*.

12.3.3. In the study of critical proportions, except for specific cases, rational critique will continue to be applied to the critical probability according to the values of the 1st TABLE.

12.3.4. The rational critique of raw scores or frequencies can be applied to infinite universes or to universes with limited options, being more functional in universes of limited options.

12.3.4.1. In universes of limited options it is more functional because the total frequency is predetermined by the number of individual measurements, regardless of the behavior of the options. The maximum raw score or frequency will always be the total frequency. In universes of infinite subjects or options, however, the maximum raw score or frequency can vary depending on the raw score of each subject or option. If more than one subject or option has a measurement other than zero, then the sum of raw scores or frequencies, taken as the maximum, will be an estimate that is not very objective, since it does not represent the maximum attainable by a single subject or option, but only the sum of the measurements. By contrast, in universes of limited options, since the total frequency limits the maximum possible frequency, this will always be attainable as long as only one subject or option is non-zero.

12.3.5. Validity and Sample Level

12.3.5.1. *Validity of Equality* in raw scores or frequencies is equal to the critical value, xc, minus the absolute value of the differential score. If the result is zero or positive, the tendency toward equality of opportunities is accepted. The critical value, xc, is equal to the product of the error percentage X, divided by one hundred, multiplied by the *Maximum Possible Theoretical Differential Score*:

$$\text{Validity of Equality} = xc - |\, x_i - \bar{x}\,| = \text{zero or positive} \rightarrow \text{equality of opportunities accepted}$$

$$xc = (\sum x_i - \bar{x}) \cdot (X : 100)$$

$$X = \text{percentage of error}$$

12.3.5.2. *Validity of Positive Bias* in raw scores or frequencies is equal to the differential score minus a critical value, xc. If the result is zero or positive, the tendency toward positive bias is accepted. The critical value, xc, is equal to the reliability percentage X, divided by one hundred, multiplied by the *Maximum Possible Theoretical Differential Score*:

$$\text{Validity of Positive Bias} = (x_i - \bar{x}) - xc = \text{zero or positive} \rightarrow \text{positive bias accepted}$$

$$xc = (\sum x_i - \bar{x}) \cdot (X : 100)$$

$$X = \text{percentage of reliability}$$

12.3.5.3. *Validity of Negative Bias* in raw scores or frequencies is the difference between the arithmetic mean and the raw score or frequency, and the result minus a critical value, xc. Zero or positive is accepted as sufficient tendency toward negative bias. The critical value, xc, is equal to the reliability percentage X, divided by one hundred, multiplied by the arithmetic mean:

$$\text{Validity of Negative Bias} = (\bar{x} - x_i) - xc = \text{zero or positive} \rightarrow \text{negative bias accepted}$$

$$xc = \bar{x} \cdot (X : 100)$$

$$X = \text{percentage of reliability}$$

12.3.5.4. *Critical Sample Level of Equality* using Mean Deviation: critical value, xc, minus Mean Deviation [DM, in Spanish *Desviacion Media*]. Zero or positive is accepted. The critical value, xc, equals the product of the Maximum Mean Deviation by the error percentage XXX, divided by one hundred:

$$\text{Critical Sample Level of Equality, DM} = xc - DM = \text{zero or positive} \rightarrow \text{equality accepted}$$

$$xc = \left(\frac{(\sum x_i - \bar{x}) \cdot 2}{N}\right) \cdot (X : 100)$$

$$X = \text{percentage of error}$$

DM= Mean Deviation

12.3.5.5. *Critical Sample Level of Bias* using Mean Deviation: Mean Deviation minus critical value, xc. Zero or positive is accepted. The critical value, xc, equals the product of the Maximum Mean Deviation by the reliability percentage X, divided by one hundred:

$$\text{Critical Sample Level of Bias, DM} = DM - xc = \text{zero or positive} \rightarrow \text{bias accepted}$$

$$xc = \left(\frac{(\sum x_i - \bar{x}) \cdot 2}{N}\right) \cdot (X : 100)$$

$$X = \text{percentage of reliability}$$

DM= Mean Deviation

12.3.5.6. *Critical Sample Level of Equality* using Standard Deviation: critical value, xc, minus Standard Deviation (S). Zero or positive is accepted. The critical value, xc, equals the product of the Maximum Standard Deviation by the error percentage X, divided by one hundred:

$$\text{Critical Sample Level of Equality, S} = xc - S = \text{zero or positive} \rightarrow \text{equality accepted}$$

$$xc = \sqrt{\frac{(\sum x_i - \bar{x})^2 + (\bar{x}^2 \cdot (N-1))}{N}} \cdot (X : 100)$$

$$X = \text{percentage of error}$$

S= Standard Deviation

12.3.5.7. *Critical Sample Level of Bias* using Standard Deviation: Standard Deviation minus critical value, xc. Zero or positive is accepted. The critical value, xc, equals the product of the Maximum Standard Deviation by the reliability percentage X, divided by one hundred:

$$\text{Critical Sample Level of Bias, S} = S - xc = \text{zero or positive} \rightarrow \text{bias accepted}$$

$$xc = \sqrt{\frac{(\sum x_i - \bar{x})^2 + (\bar{x}^2 \cdot (N-1))}{N}} \cdot (X : 100)$$

$$X = \text{percentage of reliability}$$

S= Standard Deviation

12.3.6. Significance

12.3.6.1. *Significance of Equality* in raw scores or frequencies: difference between the Maximum Possible Theoretical Differential Score and the absolute value of the differential score, and the result minus the critical value, xc. If the result is zero or positive, the tendency toward equality of opportunities is accepted. The critical value, xc, is equal to the reliability percentage X, divided by one hundred, multiplied by the Maximum Possible Theoretical Differential Score:

$$\text{Significance of Equality} = \left[\left(\sum x_i - \bar{x}\right) - \left|\, x_i - \bar{x} \,\right|\right] - xc = \text{zero or positive} \rightarrow \text{equality of opportunities accepted}$$

$$xc = \left(\sum x_i - \bar{x}\right) \cdot (X : 100)$$

$$X = \text{percentage of reliability}$$

12.3.6.2. *Significance of Positive Bias* in raw scores or frequencies: equal to the critical value, xc, minus the difference between the Maximum Possible Theoretical Differential Score and the differential score. Zero or positive is accepted as positive bias. The critical value, xc, is equal to the error percentage X, divided by one hundred, multiplied by the Maximum Possible Theoretical Differential Score:

$$\text{Significance of Positive Bias} = xc - \left[\left(\sum x_i - \bar{x}\right) - \left(x_i - \bar{x}\right)\right] = \text{zero or positive} \rightarrow \text{positive bias accepted}$$

$$xc = \left(\sum x_i - \bar{x}\right) \cdot (X : 100)$$

$$X = \text{percentage of error}$$

12.3.6.3. Significance of Negative Bias in Raw Scores or Frequencies

Equal to the critical value, xc, minus the difference between the arithmetic mean and the difference of the arithmetic mean minus the raw score or frequency. Zero or positive is accepted as negative bias. The critical value, xc, is equal to the error percentage X, divided by one hundred, times the arithmetic mean.

$$\text{Significance of Negative Bias} = xc - [\bar{x} - (\bar{x} - x_i)] = \text{zero or positive} \rightarrow \text{negative bias accepted}$$

$$xc = \bar{x} \cdot (X : 100)$$

$$X = \text{percentage of error}$$

12.3.6.4. Significance of Bias in Mean Deviation (DM) (Raw Scores or Frequencies)

Critical value, xc, minus the differential between Maximum Mean Deviation and Mean Deviation. Zero or positive is accepted as sample bias. The critical value, xc, is equal to the product of Maximum Mean Deviation by the error percentage X, divided by one hundred.

$$\text{Significance of Bias in Mean Deviation} = xc - \left\{\left(\frac{(\sum x_i - \bar{x}) \cdot 2}{N}\right) - DM\right\} = \text{zero or positive} \rightarrow \text{bias accepted}$$

$$xc = \left(\frac{(\sum x_i - \bar{x}) \cdot 2}{N}\right) \cdot (X : 100)$$

$$X = \text{percentage of error}$$

DM= Mean Deviation

12.3.6.5. Significance of Equality in Mean Deviation (MD) (Raw Scores or Frequencies)

Maximum Mean Deviation minus the Mean Deviation, and the result minus a critical value, xc. Zero or positive is accepted as the sample's tendency toward equality of opportunities. The critical value, xc, is equal to the product of Maximum Mean Deviation by the reliability percentage X, divided by one hundred.

$$\text{Significance of Equality in Mean Deviation} = \left\{\left(\frac{(\sum x_i - \bar{x}) \cdot 2}{N}\right) - DM\right\} - xc = \text{zero or positive}$$

$$xc = \left(\frac{(\sum x_i - \bar{x}) \cdot 2}{N}\right) \cdot (X : 100)$$

$$X = \text{percentage of reliability}$$

DM= Mean Deviation

12.3.6.6. Significance of Bias in Standard Deviation (S) (Raw Scores or Frequencies)

Critical value, xc, minus the differential between Maximum Standard Deviation and Standard Deviation. If zero or positive, the tendency toward bias in the sample is accepted. The critical value, xc, is equal to the product of the Maximum Standard Deviation by the error percentage X, divided by one hundred.

$$\text{Significance of Bias in Standard Deviation} = xc - \left\{\sqrt{\frac{(\sum x_i - \bar{x})^2 + (\bar{x}^2 \cdot (N-1))}{N}} - S\right\} = \text{zero or positive}$$

$$xc = \sqrt{\frac{(\sum x_i - \bar{x})^2 + (\bar{x}^2 \cdot (N-1))}{N}} \cdot (X : 100)$$

$$X = \text{percentage of error}$$

S = Standard Deviation

12.3.6.7. Significance of Equality in Standard Deviation (Raw Scores or Frequencies)

Difference between Maximum Standard Deviation and Standard Deviation, and the result minus a critical value, xc. Zero or positive is accepted as sufficient sample tendency toward equality of opportunities. The critical value, xc, is equal to the reliability percentage X, divided by one hundred, times the Maximum Standard Deviation.

$$\text{Significance of Equality in Standard Deviation} = \left\{ \sqrt{\frac{(\sum x_i - \bar{x})^2 + (\bar{x}^2 \cdot (N-1))}{N}} - S \right\} - xc = \text{zero or positive}$$

$$xc = \sqrt{\frac{(\sum x_i - \bar{x})^2 + (\bar{x}^2 \cdot (N-1))}{N}} \cdot (X : 100)$$

$$X = \text{percentage of reliability}$$

12.3.7. Introduction to Critical Proportions, Individual or Sample, and Critical Probabilities of Differential Scores

12.3.7.1. The main advantage of Critical Proportions, except in certain exceptions, is that they can be rationally critiqued through critical probabilities from the 1st TABLE.

12.3.7.2. For the rational critique of Probabilities of Differential Score, the way of calculating the critical probability will be presented according to the object of study.

12.4. Critical Proportions, Individual and Sample

12.4.1. Individual Critical Proportions

12.4.1.1. Theoretical Individual Critical Proportions

12.4.1.1.1. Theoretical Individual Critical Proportion of Equality

12.4.1.1.1.1. *Theoretical Individual Proportion of Equality*: one minus the quotient of the absolute value of the differential score over the Maximum Possible Theoretical Differential Score.

$$\text{Proportion of Equality} = 1 - \frac{|x_i - \bar{x}|}{(\sum x_i - \bar{x})}$$

12.4.1.1.1.2. *Theoretical Individual Critical Proportion of Equality*: one minus the quotient of the absolute value of the differential score over the Maximum Possible Theoretical Differential Score, and then subtracting the critical probability. Zero or positive is accepted as sufficient tendency toward equality of opportunities. The critical probability is the reliability percentage X divided by one hundred, according to the 1st TABLE.

$$\text{Theoretical Individual Critical Proportion of Equality} = \left\{1 - \frac{|x_i - \bar{x}|}{(\sum x_i - \bar{x})}\right\} - p(xc) = \text{zero or positive}$$

$$p(xc) = X : 100$$

$$X = \text{percentage of reliability}$$

12.4.1.1.1.3. *Theoretical Individual Percentage of Equality*: product of one hundred by the difference of one minus the quotient of the absolute value of the differential score over the Maximum Possible Theoretical Differential Score.

$$\text{Theoretical Individual Percentage of Equality} = \left\{1 - \frac{|x_i - \bar{x}|}{(\sum x_i - \bar{x})}\right\} \cdot 100$$

12.4.1.1.1.4. *Theoretical Individual Critical Percentage of Equality*: product of one hundred by the difference of one minus the quotient of the absolute value of the differential score over the Maximum Possible Theoretical Differential Score, and the result minus a reliability percentage X. Zero or positive is accepted as equality of opportunities.

$$\text{Theoretical Individual Critical Percentage of Equality} = \left\{\left(1 - \frac{|x_i - \bar{x}|}{(\sum x_i - \bar{x})}\right) \cdot 100\right\} - X = \text{zero or positive}$$

$$X = \text{percentage of reliability}$$

12.4.1.1.2. Theoretical Individual Critical Proportion of Positive Bias

12.4.1.1.2.1. *Theoretical Individual Proportion of Positive Bias*: differential score over Maximum Possible Theoretical Differential Score.

$$\text{Theoretical Individual Proportion of Positive Bias} = \frac{(x_i - \bar{x})}{(\sum x_i - \bar{x})}$$

12.4.1.1.2.2. *Theoretical Individual Critical Proportion of Positive Bias*: differential score over Maximum Possible Theoretical Differential Score, and the result minus a critical probability. Zero or positive is accepted as sufficient tendency toward positive bias. The critical probability is equal to the reliability percentage X divided by one hundred, from the 1st TABLE.

$$\text{Theoretical Individual Critical Proportion of Positive Bias} = \frac{(x_i - \bar{x})}{(\sum x_i - \bar{x})} - p(xc) = \text{zero or positive}$$

$$p(xc) = X : 100$$

$$X = \text{percentage of reliability}$$

12.4.1.1.2.3. *Theoretical Individual Percentage of Positive Bias*: product of one hundred by the quotient of the differential score over the Maximum Possible Theoretical Differential Score.

$$\text{Theoretical Individual Percentage of Positive Bias} = \left(\frac{x_i - \bar{x}}{\sum x_i - \bar{x}}\right) \cdot 100$$

12.4.1.1.2.4. *Theoretical Individual Critical Percentage of Positive Bias*: product of one hundred by the quotient of the differential score over the Maximum Possible Theoretical Differential Score, and the result minus a reliability percentage X. Zero or positive is accepted as sufficient tendency toward positive bias.

$$\text{Theoretical Individual Critical Percentage of Positive Bias} = \left(\frac{x_i - \bar{x}}{\sum x_i - \bar{x}} \cdot 100\right) - X = \text{zero or positive}$$

$$X = \text{percentage of reliability}$$

12.4.1.1.3. Theoretical Individual Critical Proportion of Negative Bias

12.4.1.1.3.1. *Theoretical Individual Proportion of Negative Bias*: difference between the arithmetic mean and the raw score or frequency, and the result divided by the arithmetic mean.

$$\text{Theoretical Individual Proportion of Negative Bias} = \frac{(\bar{x} - x_i)}{\bar{x}}$$

12.4.1.1.3.2. *Theoretical Individual Critical Proportion of Negative Bias*: difference between the arithmetic mean and the raw score or frequency, and the result divided by the arithmetic mean; the quotient minus the critical probability. Zero or positive is accepted as sufficient tendency toward negative bias. The critical probability equals the reliability percentage X divided by one hundred (1st TABLE).

$$\text{Theoretical Individual Critical Proportion of Negative Bias} = \left[(\bar{x} - x_i) : \bar{x} \right] - p(x_c) \ = \ \text{zero or positive}$$

$$p(x_c) = X : 100$$

$$X = \text{percentage of reliability}$$

12.4.1.1.3.3. *Theoretical Individual Percentage of Negative Bias*: difference between the arithmetic mean and the raw score or frequency, divided by the arithmetic mean, and the quotient times one hundred.

$$\text{Theoretical Individual Percentage of Negative Bias} = \Big[(\bar{x} - x_i) : \bar{x} \Big] \cdot 100$$

12.4.1.1.3.4. *Theoretical Individual Critical Percentage of Negative Bias*: difference between the arithmetic mean and the raw score or frequency, divided by the arithmetic mean, times one hundred; the product minus a reliability percentage X. Zero or positive is accepted as sufficient tendency toward negative bias.

$$\text{Theoretical Individual Critical Percentage of Negative Bias} = \Big\{ \big[(\bar{x} - x_i) : \bar{x} \big] \cdot 100 \Big\} - X \ = \ \text{zero or positive}$$

$$X = \text{percentage of reliability}$$

12.4.1.2. Empirical Individual Critical Proportions

12.4.1.2.1. Empirical Individual Critical Proportion of Equality

12.4.1.2.1.1. *Empirical Individual Proportion of Equality*: one minus the quotient of the absolute value of the differential score over the *Maximum Possible Empirical Differential Score*. The Maximum Possible Empirical Differential Score equals one half of the sum of absolute values of all differential scores.

$$\text{Empirical Individual Proportion of Equality} = 1 - \left\{ |x_i - \bar{x}| : \left[\sum |x_i - \bar{x}| : 2 \right] \right\}$$

12.4.1.2.1.2. *Empirical Individual Critical Proportion of Equality*: one minus the quotient of the absolute differential over the Maximum Possible Empirical Differential Score, and the result minus the critical probability. Zero or positive → equality of opportunities accepted. The critical probability equals the reliability percentage X divided by one hundred (1st TABLE).

$$\text{Empirical Individual Critical Proportion of Equality} = \left\{ 1 - \left[|x_i - \bar{x}| : \left(\sum |x_i - \bar{x}| : 2 \right) \right] \right\} - p(x_c)$$

$$p(x_c) = X : 100 \qquad X = \text{percentage of reliability}$$

12.4.1.2.1.3. *Empirical Individual Percentage of Equality*: one hundred times the difference of one minus the quotient of the absolute differential over the Maximum Possible Empirical Differential Score.

$$\text{Empirical Individual Percentage of Equality} = \left\{1 - \left[\, |x_i - \bar{x}| : \left(\sum |x_i - \bar{x}| : 2\right) \right]\right\} \cdot 100$$

12.4.1.2.1.4. *Empirical Individual Critical Percentage of Equality*: one hundred times the difference of one minus that quotient, and the result minus a reliability percentage X.

$$\text{Empirical Individual Critical Percentage of Equality} = \left\{\left\{1 - \left[\, |x_i - \bar{x}| : \left(\sum |x_i - \bar{x}| : 2\right) \right]\right\} \cdot 100\right\} - X$$

$$X = \text{percentage of reliability}$$

12.4.1.2.2. Empirical Individual Critical Proportion of Positive Bias

12.4.1.2.2.1. *Empirical Individual Proportion of Positive Bias*: quotient of the differential score over the Maximum Possible Empirical Differential Score.

$$\text{Empirical Individual Proportion of Positive Bias} = (x_i - \bar{x}) : \left[\sum |x_i - \bar{x}| : 2\right]$$

12.4.1.2.2.2. *Empirical Individual Critical Proportion of Positive Bias*: the same quotient minus the critical probability. Zero or positive → positive bias accepted. The critical probability equals the reliability percentage X divided by one hundred (1st TABLE).

$$\text{Empirical Individual Critical Proportion of Positive Bias} = \left\{(x_i - \bar{x}) : \left[\sum |x_i - \bar{x}| : 2\right]\right\} - p(x_c)$$

$$p(x_c) = X : 100 \qquad X = \text{percentage of reliability}$$

12.4.1.2.2.3. *Empirical Individual Percentage of Positive Bias*: one hundred times the quotient of the differential over the Maximum Possible Empirical Differential Score.

$$\text{Empirical Individual Percentage of Positive Bias} = \left\{(x_i - \bar{x}) : \left[\sum |x_i - \bar{x}| : 2\right]\right\} \cdot 100$$

12.4.1.2.2.4. *Empirical Individual Critical Percentage of Positive Bias*: one hundred times that quotient, minus a reliability percentage X. Zero or positive is accepted.

$$\text{Empirical Individual Critical Percentage of Positive Bias} = \left\{\left((x_i - \bar{x}) : \left[\sum |x_i - \bar{x}| : 2\right]\right) \cdot 100\right\} - X$$

$$X = \text{percentage of reliability}$$

12.4.1.2.3. Empirical Individual Critical Proportion of Negative Bias

12.4.1.2.3.1. *Empirical Individual Proportion of Negative Bias*: difference between the arithmetic mean and the raw score or frequency, divided by the Maximum Possible Empirical Differential Score.

$$\text{Empirical Individual Proportion of Negative Bias} = (\bar{x} - x_i) : \left[\sum |x_i - \bar{x}| : 2\right]$$

12.4.1.2.3.2. *Empirical Individual Critical Proportion of Negative Bias*: the same quotient minus the critical probability; zero or positive is accepted. The critical probability equals the reliability percentage x divided by one hundred, multiplied by the quotient of the arithmetic mean over the Maximum Possible Empirical Differential Score.

$$\text{Empirical Individual Critical Proportion of Negative Bias} = \left\{(\bar{x} - x_i) : \left[\sum |x_i - \bar{x}| : 2\right]\right\} - p(x_c)$$

$$p(x_c) = \left\{\bar{x} : \left[\sum |x_i - \bar{x}| : 2\right]\right\} \cdot (X : 100)$$

$$X = \text{percentage of reliability}$$

12.4.1.2.3.3. *Empirical Individual Percentage of Negative Bias*: one hundred times the quotient of the differential score over the Maximum Possible Empirical Differential Score.

$$\text{Empirical Individual Percentage of Negative Bias} = \left\{(\bar{x} - x_i) : \left[\sum |x_i - \bar{x}| : 2\right]\right\} \cdot 100$$

12.4.1.2.3.4. Empirical Individual Critical Percentage of Negative Bias

Product of one hundred by the quotient of the difference (arithmetic mean minus raw score or frequency) over the *Maximum Possible Empirical Differential Score*, and the result minus a critical value XC. The critical value XC equals one hundred times the critical probability; the critical probability equals the reliability percentage X, divided by one hundred, times the quotient of the arithmetic mean over the *Maximum Possible Empirical Differential Score*.

$$\text{Empirical Individual Critical Percentage of Negative Bias} = \left\{\left[(\bar{x} - x_i) : \left(\sum |x_i - \bar{x}| : 2\right)\right] \cdot 100\right\} - XC$$

$$XC = \left\{\left[\bar{x} : \left(\sum |x_i - \bar{x}| : 2\right)\right] \cdot (X : 100)\right\} \cdot 100$$

$$X = \text{percentage of reliability}$$

12.4.2. Sample Critical Proportions

12.4.2.1. Theoretical Sample Critical Proportion in Mean Deviation

12.4.2.1.1. Theoretical Sample Proportion of Equality in Mean Deviation

12.4.2.1.1.1. *Sample Proportion of Theoretical Equality in Mean Deviation (DM)*: one minus the quotient of Mean Deviation (DM) over Maximum Mean Deviation.

$$\text{Sample Proportion of Theoretical Equality in Mean Deviation} = 1 - \left\{ DM : \left[\left(\sum x_i - \bar{x} \right) \cdot 2 \right] : N \right\}$$

DM = Mean Deviation

12.4.2.1.1.2. *Theoretical Sample Critical Proportion of Equality in Mean Deviation*: one minus that quotient, and the result minus the critical probability. Zero or positive → equality accepted. Critical probability per 1st TABLE, reliability percentage XXX over one hundred.

$$\text{Theoretical Sample Critical Proportion of Equality in Mean Deviation} = \left\{ 1 - \left\{ DM : \left[\left(\sum x_i - \bar{x} \right) \cdot 2 \right] : N \right\} \right\} - p(x_c)$$

$$p(x_c) = X : 100, \quad X = \text{percentage of reliability}$$

DM = Mean Deviation

12.4.2.1.1.3. *Sample Percentage of Theoretical Equality in Mean Deviation*: one hundred times the difference of one minus the quotient.

$$\text{Sample Percentage of Theoretical Equality in Mean Deviation} = \left\{1 - \{DM : [(\sum x_i - \bar{x}) \cdot 2] : N\}\right\} \cdot 100$$

DM = Mean Deviation

12.4.2.1.1.4. *Theoretical Sample Critical Percentage of Equality in Mean Deviation*: one hundred times the above difference, and the result minus a reliability percentage XXX. Zero or positive → equality accepted.

$$\text{Theoretical Sample Critical Percentage of Equality in Mean Deviation} = \left\{\left\{1 - \{DM : [(\sum x_i - \bar{x}) \cdot 2] : N\}\right\} \cdot 100\right\} - X$$

$$X = \text{percentage of reliability}$$

DM = Mean Deviation

12.4.2.1.2. Theoretical Sample Proportion of Bias in Mean Deviation

12.4.2.1.2.1. *Sample Proportion of Theoretical Bias in Mean Deviation*: quotient of Mean Deviation over Maximum Mean Deviation.

$$\text{Sample Proportion of Theoretical Bias in Mean Deviation} = DM : \left\{ [(\sum x_i - \bar{x}) \cdot 2] : N \right\}$$

DM = Mean Deviation

12.4.2.1.2.2. *Theoretical Sample Critical Proportion of Bias in Mean Deviation*: the same quotient minus the critical probability; if zero or positive, bias is accepted. Critical probability per 1st TABLE, reliability percentage X over one hundred.

$$\text{Theoretical Sample Critical Proportion of Bias} = \left\{ DM : [(\sum x_i - \bar{x}) \cdot 2] : N \right\} - p(x_c)$$

$$p(x_c) = X : 100, \quad X = \text{percentage of reliability}$$

DM = Mean Deviation

12.4.2.1.2.3. *Sample Percentage of Theoretical Bias in Mean Deviation*: one hundred times that quotient.

$$\text{Sample Percentage of Theoretical Bias in Mean Deviation} = \left\{ DM : \left[(\sum x_i - \bar{x}) \cdot 2 \right] : N \right\} \cdot 100$$

DM = Mean Deviation

12.4.2.1.2.4. *Theoretical Sample Critical Percentage of Bias in Mean Deviation*: one hundred times the quotient; the result minus a reliability percentage XXX. Zero or positive → bias accepted (in the bias study).

$$\text{Theoretical Sample Critical Percentage of Bias in Mean Deviation} = \left\{ \left(DM : \left[(\sum x_i - \bar{x}) \cdot 2 \right] : N \right) \cdot 100 \right\} - X$$

$$X = \text{percentage of reliability}$$

DM = Mean Deviation

12.4.2.2. Theoretical Sample Critical Proportion in Variance

12.4.2.2.1. Theoretical Sample Proportion of Equality in Variance

12.4.2.2.1.1. *Sample Proportion of Theoretical Equality in Variance* (S^2): one minus the quotient of Variance over Maximum Variance.

$$\text{Sample Proportion of Theoretical Equality in Variance} = 1 - \left\{ s^2 : \left[\left(\sum x_i - \bar{x} \right)^2 + \left(\bar{x}^2 \cdot (N-1) \right) \right] : N \right\}$$

Variance= S^2

12.4.2.2.1.2. *Theoretical Sample Critical Proportion of Equality in Variance*: one minus that quotient, and the result minus a critical probability; zero or positive → equality accepted. Critical probability per 1st TABLE, reliability percentage XXX over one hundred.

$$\text{Theoretical Sample Critical Proportion of Equality in Variance} = \left\{ 1 - \left\{ s^2 : \left[\left(\sum x_i - \bar{x} \right)^2 + \left(\bar{x}^2 \cdot (N-1) \right) \right] : N \right\} \right\} - p(x_c)$$

$$p(x_c) = X : 100, \quad X = \text{percentage of reliability}$$

Variance= S^2

12.4.2.2.1.3. *Sample Percentage of Theoretical Equality in Variance*: one hundred times the above difference.

$$\text{Sample Percentage of Theoretical Equality in Variance} = \left\{1 - \{s^2 : [(\sum x_i - \bar{x})^2 + (\bar{x}^2 \cdot (N-1))] : N\}\right\} \cdot 100$$

Variance= S^2

12.4.2.2.1.4. *Theoretical Sample Critical Percentage of Equality in Variance*: one hundred times that difference; the product minus a reliability percentage XXX. Zero or positive → equality accepted.

$$\text{Theoretical Sample Critical Percentage of Equality in Variance} = \left\{\left(1 - \{s^2 : [(\sum x_i - \bar{x})^2 + (\bar{x}^2 \cdot (N-1))] : N\}\right) \cdot 100\right\} - X$$

$$X = \text{percentage of reliability}$$

Variance= S^2

12.4.2.2.2. Theoretical Sample Proportion of Bias in Variance

12.4.2.2.2.1. *Sample Proportion of Theoretical Bias in Variance*: quotient of Variance over Maximum Variance.

$$\text{Sample Proportion of Theoretical Bias in Variance} = s^2 : \left\{ [(\sum x_i - \bar{x})^2 + (\bar{x}^2 \cdot (N-1))] : N \right\}$$

Variance= S^2

12.4.2.2.2.2. *Theoretical Sample Critical Proportion of Bias in Variance*: the same quotient minus the critical probability. If zero or positive in the contrast, bias is accepted. Critical probability per 1st TABLE, reliability percentage X over one hundred.

$$\text{Theoretical Sample Critical Proportion of Bias in Variance} = \left\{ s^2 : [(\sum x_i - \bar{x})^2 + (\bar{x}^2 \cdot (N-1))] : N \right\} - p(x_c)$$

$$p(x_c) = X : 100, \quad X = \text{percentage of reliability}$$

Variance= S^2

12.4.2.2.2.3. Sample Percentage of Theoretical Bias in Variance

Product of one hundred by the quotient of Variance over Maximum Variance.

$$\text{Sample Percentage of Theoretical Bias in Variance} = \left\{ s^2 : [(\sum x_i - \bar{x})^2 + (\bar{x}^2 \cdot (N-1))] : N \right\} \cdot 100$$

Variance= S^2

12.4.2.2.2.4. Sample Critical Percentage of Theoretical Bias in Variance (bias study)

Product of one hundred by the quotient of Variance over Maximum Variance, and the result minus a reliability percentage X. If zero or positive, bias is accepted.

$$\text{Sample Critical Percentage of Theoretical Bias in Variance} = \left\{ \left(s^2 : [(\sum x_i - \bar{x})^2 + (\bar{x}^2 \cdot (N-1))] : N \right) \cdot 100 \right\} - X$$

$$X = \text{percentage of reliability}$$

Variance= S^2

12.4.2.3. Theoretical Sample Critical Proportion in Standard Deviation

12.4.2.3.1. Theoretical Sample Proportion of Equality in Standard Deviation

12.4.2.3.1.1. *Sample Proportion of Theoretical Equality in Standard Deviation*: one minus the quotient of Standard Deviation over Maximum Standard Deviation.

$$\text{Sample Proportion of Theoretical Equality in Standard Deviation} = 1 - \left\{ S : \sqrt{[(\sum x_i - \bar{x})^2 + (\bar{x}^2 \cdot (N-1))]} : N \right\}$$

S = Standard Deviation

12.4.2.3.1.2. *Theoretical Sample Critical Proportion of Equality in Standard Deviation*: one minus that quotient, and the result minus a critical probability; zero or positive → equality accepted. Critical probability per 1st TABLE, reliability percentage XXX over one hundred.

$$\text{Theoretical Sample Critical Proportion of Equality in Standard Deviation} = \left\{ 1 - \left\{ S : \sqrt{[(\sum x_i - \bar{x})^2 + (\bar{x}^2 \cdot (N-1))]} : N \right\} \right\} - p(x_c)$$

$$p(x_c) = X : 100, \quad X = \text{percentage of reliability}$$

S = Standard Deviation

12.4.2.3.1.3. *Sample Percentage of Theoretical Equality in Standard Deviation*: one hundred times the difference of one minus the quotient.

$$\text{Sample Percentage of Theoretical Equality in Standard Deviation} = \left\{1 - \left\{S : \sqrt{[(\sum x_i - \bar{x})^2 + (\bar{x}^2 \cdot (N-1))] : N}\right\}\right\} \cdot 100$$

S = Standard Deviation

12.4.2.3.1.4. *Theoretical Sample Critical Percentage of Equality in Standard Deviation*: one hundred times that difference, minus a reliability percentage XXX. Zero or positive → equality accepted.

$$\text{Theoretical Sample Critical Percentage of Equality in Standard Deviation} = \left\{\left(1 - \left\{S : \sqrt{[(\sum x_i - \bar{x})^2 + (\bar{x}^2 \cdot (N-1))] : N}\right\}\right) \cdot 100\right\} - X$$

$$X = \text{percentage of reliability}$$

S = Standard Deviation

12.4.2.3.2. Theoretical Sample Proportion of Bias in Standard Deviation

12.4.2.3.2.1. *Sample Proportion of Theoretical Bias in Standard Deviation*: quotient of Standard Deviation over Maximum Standard Deviation.

$$\text{Sample Proportion of Bias in Standard Deviation} = S : \sqrt{[(\sum x_i - \bar{x})^2 + (\bar{x}^2 \cdot (N-1))] : N}$$

S = Standard Deviation

12.4.2.3.2.2. *Theoretical Sample Critical Proportion of Bias in Standard Deviation*: the same quotient minus a critical probability. If zero or positive, bias is accepted. Critical probability: reliability percentage X over one hundred (1st TABLE).

$$\text{Theoretical Sample Critical Proportion of Bias in Standard Deviation} = \{S : \sqrt{[(\sum x_i - \bar{x})^2 + (\bar{x}^2 \cdot (N-1))] : N}\} - p(x_c)$$

$$p(x_c) = X : 100, \quad X = \text{percentage of reliability}$$

S = Standard Deviation

12.4.2.3.2.3. *Sample Percentage of Theoretical Bias in Standard Deviation*: one hundred times that quotient.

$$\text{Sample Percentage of Bias in Standard Deviation} = \left\{S : \sqrt{[(\sum x_i - \bar{x})^2 + (\bar{x}^2 \cdot (N-1))]} : N\right\} \cdot 100$$

S = Standard Deviation

12.4.2.3.2.4. *Sample Critical Percentage of Theoretical Bias in Standard Deviation*: one hundred times the quotient, minus a reliability percentage X. If zero or positive, bias is accepted.

$$\text{Sample Critical Percentage of Theoretical Bias in Standard Deviation} = \left\{\left(S : \sqrt{[(\sum x_i - \bar{x})^2 + (\bar{x}^2 \cdot (N-1))]} : N\right) \cdot 100\right\} - X$$

$$X = \text{percentage of reliability}$$

S = Standard Deviation

12.4.2.4. Empirical Sample Critical Proportion

In the Second Method, *Intermediate Deviation* is concretely the quotient of half the difference between the maximum and the minimum; its Maximum Intermediate Deviation is logically 0.5. Now, suppose that in raw scores or frequencies the subject or option that has the *Maximum Differential Score* is the one whose raw score equals the total frequency (or total of raw scores/frequencies), insofar as the other subjects or options have raw score or frequency zero. In raw scores or frequencies, the *Maximum Intermediate Dispersion* would then be equal to half of the sample total of raw scores or frequencies.

$$\text{Maximum Intermediate Dispersion (raw scores or frequencies)} = \sum x_i : 2$$

12.4.2.4.1. Empirical Sample Proportion of Equality

12.4.2.4.1.1. *Empirical Sample Proportion of Equality*: one minus the quotient of Intermediate Deviation over Maximum Intermediate Deviation, where in raw scores or frequencies the Maximum Intermediate Deviation equals half the sample total of raw scores or frequencies.

$$\text{Empirical Sample Proportion of Equality} = 1 - \left\{ \left[(x_i^{(+)} - x_i^{(-)}) : 2 \right] : (\sum x_i : 2) \right\}$$

with
$x_i^{(+)}$ = maximum raw score or frequency
$x_i^{(-)}$ = minimum raw score or frequency

12.4.2.4.1.2. *Empirical Sample Critical Proportion of Equality*: Empirical Sample Proportion of Equality minus the critical probability; zero or positive → accepted. Critical probability equals the reliability percentage X divided by one hundred.

$$\text{Empirical Sample Critical Proportion of Equality} = \left\{1 - \left\{[(x_i^{(+)} - x_i^{(-)}) : 2] : (\sum x_i : 2)\right\}\right\} - p(x_c)$$
$$p(x_c) = X : 100, \quad X = \text{percentage of reliability}$$

12.4.2.4.1.3. *Empirical Sample Percentage of Equality*: Empirical Sample Proportion of Equality times one hundred.

$$\text{Empirical Sample Percentage of Equality} = \left\{1 - \left\{[(x_i^{(+)} - x_i^{(-)}) : 2] : (\sum x_i : 2)\right\}\right\} \cdot 100$$

12.4.2.4.1.4. Sample Critical Percentage of Empirical Equality

Sample Percentage of Empirical Equality minus a reliability percentage XXX. Zero or positive → equality accepted.

$$\text{Sample Critical Percentage of Empirical Equality} = \left\{\left\{1 - \left\{[(x_i^{(+)} - x_i^{(-)}) : 2] : (\sum x_i : 2)\right\}\right\} \cdot 100\right\} - X$$
$$X = \text{percentage of reliability}$$

12.4.2.4.2. Sample Critical Proportion of Empirical Bias

12.4.2.4.2.1. *Sample Proportion of Empirical Bias*: *Intermediate Deviation* over *Maximum Intermediate Deviation*, for raw scores or frequencies.

$$\text{Sample Proportion of Empirical Bias} = \left[(x_i^{(+)} - x_i^{(-)}) : 2\right] : (\sum x_i : 2)$$

12.4.2.4.2.2. *Sample Critical Proportion of Empirical Bias*: *Sample Proportion of Empirical Bias* minus the critical probability. Zero or positive → bias accepted. Critical probability equals the reliability percentage X divided by one hundred.

$$\text{Sample Critical Proportion of Empirical Bias} = \left\{ \left[(x_i^{(+)} - x_i^{(-)}) : 2\right] : (\sum x_i : 2) \right\} - p(x_c)$$

$$p(x_c) = X : 100, \qquad X = \text{percentage of reliability}$$

12.4.2.4.2.3. *Sample Percentage of Empirical Bias*: *Sample Proportion of Empirical Bias* times one hundred.

$$\text{Sample Percentage of Empirical Bias} = \left\{ \left[(x_i^{(+)} - x_i^{(-)}) : 2 \right] : (\sum x_i : 2) \right\} \cdot 100$$

12.4.2.4.2.4. *Sample Critical Percentage of Empirical Bias*: *Sample Percentage of Empirical Bias* minus a reliability percentage X. Zero or positive → bias accepted.

$$\text{Sample Critical Percentage of Empirical Bias} = \left\{ \left[(x_i^{(+)} - x_i^{(-)}) : 2 \right] : (\sum x_i : 2) \cdot 100 \right\} - X$$

$$X = \text{percentage of reliability}$$

12.5. Critique of Probabilities of Differential Score

12.5.1. Critique of the Probability of Equality in Raw Scores or Frequencies

12.5.1.1. *Probability of Equality* in raw scores or frequencies: difference of 0.5 minus the quotient of the absolute value of the differential score over the *Total of Differential Scores*. The reason the proportion is subtracted from 0.5 is that if a subject or option had the *Maximum Possible Empirical Differential Score* (i.e., *Total of Differential Scores* divided by two), then dividing by the *Total of Differential Scores* will logically yield 0.5. Therefore, to later test against a reliability margin, we should subtract from 0.5 the quotient—under equality of opportunities—of the absolute differential over the *Total of Differential Scores*.

$$\text{Probability of Equality} = 0.5 - \left[|x_i - \bar{x}| : \sum |x_i - \bar{x}| \right]$$

12.5.1.2. *Critique of the Probability of Equality* in raw scores or frequencies: 0.5 minus the quotient of the absolute differential over the *Total of Differential Scores*, and the result minus a critical probability. Zero or positive → equality of opportunities accepted. Critical probability equals 0.5 times the reliability percentage X divided by one hundred.

$$\text{Critique of the Probability of Equality} = \left\{ 0.5 - \left[|x_i - \bar{x}| : \sum |x_i - \bar{x}| \right] \right\} - p(x_c)$$

$$p(x_c) = 0.5 \cdot (X : 100), \qquad X = \text{percentage of reliability}$$

12.5.2. Rational Critique of the Probability of Positive Bias in Raw Scores or Frequencies

12.5.2.1. *Probability of Positive Bias*: differential score over *Total of Differential Scores*.

$$\text{Probability of Positive Bias} = (x_i - \bar{x}) : \sum |x_i - \bar{x}|$$

12.5.2.2. *Rational Critique of the Probability of Positive Bias*: the same quotient minus a critical probability. Zero or positive → positive bias accepted. Critical probability equals the reliability percentage X divided by one hundred, times 0.5.

$$\text{Critique of the Probability of Positive Bias} = \left[(x_i - \bar{x}) : \sum |x_i - \bar{x}|\right] - p(x_c)$$

$$p(x_c) = 0.5 \cdot (X : 100), \qquad X = \text{percentage of reliability}$$

12.5.3. Rational Critique of the Probability of Negative Bias in Raw Scores or Frequencies

12.5.3.1. *Probability of Negative Bias*: difference of the arithmetic mean minus the raw score or frequency, over the *Total of Differential Scores*.

$$\text{Probability of Negative Bias} = (\bar{x} - x_i) : \sum |x_i - \bar{x}|$$

12.5.3.2. *Critique of the Probability of Negative Bias*: difference of the mean minus the raw score or frequency, over the *Total of Differential Scores*; the quotient minus a critical probability. Zero or positive → negative bias accepted. The critical probability equals the reliability percentage X divided by one hundred, times the quotient of the arithmetic mean over the *Total of Differential Scores*.

$$\text{Critique of the Probability of Negative Bias} = \left[(\bar{x} - x_i) : \sum |x_i - \bar{x}|\right] - p(x_c)$$

$$p(x_c) = \left[\bar{x} : \sum |x_i - \bar{x}|\right] \cdot (X : 100), \qquad X = \text{percentage of reliability}$$

12.6. Study of Raw Scores or Frequencies Under Omega Conditions

12.6.1. Assessing the Nature of Options in the Rational Critique of Raw Scores or Frequencies

12.6.1.1. Up to now, all the equations presented in this section for the rational critique of raw scores or frequencies are statistical tests of equality of opportunities or bias (positive or negative), which—when studying positive bias—are valid only under the hypothesis that within the whole N there is a single subject or option that is ideal.

12.6.1.2. The statistical test models for the rational critique of raw scores or frequencies can be applied to any universe, infinite or limited, being more functional in limited universes (with limited options), insofar as, given a determined total frequency, they study the distribution of that frequency among the options.

12.6.1.3. Thus, while they are more functional in empirical models of limited options, it is normally the case in such models that, given N options, if the study concerns bias, the ideal option is a single one—although omega models may also arise, as well as equality-of-opportunity models where the entire N is, by itself, of equal relevance.

12.6.1.4. If a teacher designs an ***intelligence test*** with several answer options per item, there will usually be **only one correct option**. If we study social behavior regarding the environment, the most normal case is that there is only one ideal behavior: ***ecological behavior***. If several candidates or delegates stand in democratic elections, it is most common that—depending on the political options each candidate or delegate defends—for each political option there will always be ***one candidate or delegate*** who is the most ideal. If we structure a magnitude into discrete categories, it is true there may be different categories at different magnitudes of measurement; but usually among them there will always be one which, for whatever reason, is the most ideal—either because its upper bound is the largest magnitude in the sample, or because, although other categories may have larger magnitudes, there may be categories that, without reaching a high magnitude and being of moderate magnitude, are more realistic

to become a sufficiently acceptable statistical norm and thus become the mode, the maximum, even if of moderate magnitude.

12.6.1.5. If, in a study of limited options, all options are non-ideal, the ideal would be a *sample of zeros*. However, faced with the non-ideal, the antithesis may arise—an ideal option that negates all the non-ideal ones—transforming a study of negative bias into one of positive bias; or, if all non-ideal options are non-ideal in differing degrees of severity, the *Impact of the Defect* can be applied.

12.6.1.6. In fact, any study of negative bias can be transformed into a study of positive bias, except the *sample of zeros*.

12.6.1.7. If within N there were only a single subject or option whose negative bias should be the maximum possible—either because it is interpreted as a non-ideal option or because the ideal would be for it to be the only negative bias in the entire N—then all the other subjects or options would be interpreted as ideal, and the study of that sole non-ideal subject or option, or whose ideal is to maximize its negative bias, would become a study of the sample under omega conditions, with omega) equal to N−1; that is, N minus that single non-ideal subject or option (the one whose ideal would be to maximize its negative bias).

12.6.1.8. In any case, in limited universes the most normal situation will be either a study of equality of opportunities or of positive bias. The question is to discern whether it is positive bias under the hypothesis of a single ideal subject or option, or under omega conditions of a subset of ideals greater than one and less than N—that is, a subset of ideals between two and N−1, but always with N>2.

12.6.1.9. All the equations presented in this section so far for the rational critique of raw scores or frequencies, when the object of study was positive bias, have been made under the hypothesis that a single subject or option was the ideal.

12.6.1.10. The equations presented below in this section will be for the rational critique of raw scores or frequencies under omega conditions.

12.6.1.11. A given study is said to be conducted under omega conditions when the object of study is the positive bias of a subset of ideals—ideal subjects or options—

greater than one and less than N, and thus the subset of ideals may have variable magnitude between two and N−1 subjects or options.

12.6.1.12. Although studies under omega conditions can be applied to any universe, infinite or limited, when critiquing raw scores or frequencies they will be more functional in limited universes—though never in universes limited to only two options.

12.6.2. Omega Validity in Raw Scores or Frequencies

$$x_i - x_c = \text{zero or positive} \rightarrow \text{positive bias accepted}$$

$$x_c = (\sum x_i : \Omega) \cdot (X : 100)$$

$$X = \text{percentage of reliability}$$

12.6.3. Omega Sample Level in Raw Scores or Frequencies

12.6.3.1. Omega Sample Level in raw scores or frequencies, using Mean Deviation (DM)

$$DM - p(x_c) = \text{zero or positive} \rightarrow \text{accepted}$$

$$p(x_c) = \left\{ \left\{ \left[\left((\sum x_i : \Omega) - \bar{x} \right) \cdot \Omega \right] + \left[\bar{x} \cdot (N - \Omega) \right] \right\} : N \right\} \cdot (X : 100)$$

$$X = \text{percentage of reliability}$$

DM= Mean Deviation

12.6.3.2. Omega Sample Level in raw scores or frequencies, using Standard Deviation

$$S - p(x_c) = \text{zero or positive} \rightarrow \text{accepted}$$

$$p(x_c) = \sqrt{\left\{\left\{\left[\left(\left(\sum x_i : \Omega\right) - \bar{x}\right)^2 \cdot \Omega\right] + \left[\bar{x}^2 \cdot (N - \Omega)\right]\right\} : N\right\}} \cdot (X : 100)$$

$$X = \text{percentage of reliability}$$

S = Standard Deviation

12.7. Equifinality in *Impossible Probability*

12.7.1. *Equifinality* is said to occur when the same end can be reached through different paths, any of which is equally valid for the intended purpose. Equifinality is one of the main characteristics of systemic models that have emerged in science since Bertalanffy's General Systems Theory [GAI can be included within these models]. In fact, the systemic model itself is a dialectical model, since many dialectical characteristics are embedded in systemic models—for example, that any simple variation in any part of a system can produce decisive variations in the entire system, an idea that is, moreover, dialectical.

12.7.2. In *Impossible Probability*, equifinality can be observed in the way the rational critique of reality can be carried out from different models of rational critique, all equally valid, with scientific policy deciding which is better for its objectives according to the advantages each can offer, in the rational critique of reality itself, in order to arrive at knowledge—albeit partial and objective—within the margin of error one is willing to accept, within the margin of incoherence within which the logical coherence of the theory is decided.

12.7.3. Throughout this section we have studied how to adapt all the models of rational critique to the study of raw scores or frequencies, in accordance with the models

previously offered for the same purpose regarding critical probability. In studies of raw scores or frequencies using critical proportions and the Probability of Equality or Bias—Positive or Negative—in differential scores, the rational critique, although in the rational critique of reality itself for raw scores or frequencies, again comes to be conducted in terms of critical probabilities; that is, the ideal critical reason itself, the *critical probability*, which is again equally valid in certain models of rational critique of raw scores or frequencies.

12.7.4. The fact that the rational-critique models studied in section eleven (on critical probability) and those studied in section twelve (on the rational critique of raw scores or frequencies) can be used interchangeably in the rational critique of reality itself—whether the reality in question is statistical probability or raw scores/frequencies—implies that, whenever both paths are applicable, the critique of real reality (material reality outside itself) would be equally feasible and valid by either path. The condition "whenever both paths are applicable" is included because they may not always be equally applicable, since rational-critique models for raw scores or frequencies are more functional in universes of limited options, where both paths could be applied interchangeably. However, from the logic of *Impossible Probability*, unless the design of the research plan requires the rational critique of raw scores or frequencies, the rational critique of empirical probabilities will be much more practical.

12.7.5. The fact that different models exist for the same function implies that scientific policy, in designing the study, must select which models to use in the rational critique of the data derived from the sample.

12.7.6. Although in this section twelve the way to adapt rational-critique models of statistical probability to the rational critique of raw scores or frequencies has been shown, *Impossible Probability*, as a theory of probability, will always give preference to the rational critique of statistical probability, since the statistics of probability offers a series of advantages that the reality of raw scores or frequencies does not—for example, the statistics of probability allows us to know *a priori*, from the magnitude N, the values of maximum individual theoretical tendency and the values of maximum sample theoretical tendency.

12.7.7. Simply by knowing N, through the reciprocal of N, we can know the arithmetic mean—the theoretical probability of random occurrence under equality of opportunities—and, in universes of infinite subjects or options, the theoretical dispersion, the error of sample representativeness, the theoretical margin of oscillation around the central tendency, and the margin of random bias in theory. And in any kind of universe, knowing the magnitude N, its reciprocal then gives: *Maximum Possible Negative Bias*; the difference of one minus the reciprocal of N equal to *Maximum Possible Theoretical Bias*; the average of twice the *Maximum Possible Theoretical Bias* equal to the *Maximum Possible Theoretical Mean Deviation*; and the average of the sum of the square of the *Maximum Possible Theoretical Bias* plus the square of the reciprocal of N times N−1 equal to the *Maximum Possible Theoretical Variance*; and its square root, the *Maximum Possible Theoretical Standard Deviation*. Furthermore, via the reciprocal of N and the reciprocal of the raw scores or frequencies, we can conduct a critical study of whether a sample is sufficiently representative—through *Sample Sufficiency*, the *Critical Normality Requirement*, and the *Normality Requirement*—options for studying sample representativeness that can be carried out simply by knowing *a priori* the magnitude of both samples.

12.7.8. The main advantage offered by the rational critique of reality itself formed by the sample of statistical probabilities lies in the fact that, knowing the magnitude N, one can access knowledge of all theoretical statistics, of sample tendency or of maximum possible dispersion—an advantage that, however, is not available in the rational critique of reality itself formed by the sample of raw scores or frequencies.

12.7.9. In any case, whether a rational critique concerns statistical probabilities (in the statistics of probability) or raw scores or frequencies, it is always necessary that every rational critique of *individual* reality be validated by the rational critique of *sample* reality, in order to infer that a true individual behavior—of a subject or option—is morally universal.

12.7.10. Every statistical decision issued on the sufficiency of the individual tendency—be it in Validity or Significance, or Individual Critical Proportion, or Probability (of Equality, Positive Bias, or Negative Bias)—must necessarily entail, for acceptance of the empirical hypothesis, a critical study of the sufficiency of the sample tendency,

whether in Validity, Significance, or Sample Critical Proportion of Equality or Bias. Every statistical decision to infer a universal tendency must necessarily involve the study of the sufficiency of both the individual and sample tendencies. A moral judgment about universal tendency from an individual tendency without validation at the sample level will be an inference about the universal that lacks real meaning or value, insofar as it lacks the necessary or sufficient awareness to explain or understand the individual tendency within the universal tendency represented in the sample—provided the sample is truly representative of its universe. Likewise, a moral judgment about universal tendencies based solely on the sufficiency of the sample, without awareness of individual reality, would imply a political decision about what happens in real reality without being aware of what truly happens at the individual level.

12.7.11. The moral explanation or understanding of the universe is only possible through isomorphism in individual or universal causal attributions. ***To attempt to issue a moral value judgment about behavior without being aware of all its causes would be a procedural error***, as it would imply acceptance of an empirical hypothesis without awareness of all the real dimensions of that hypothesis. The logical process of universal inference must be—from validating individual tendencies—to deducing what individual behavior is morally universal: that ideal behavior model both at the individual level (whether of the subject or the option) and at the sample level if, morally, the sample is representative of the universe; so that, whenever the sample is morally representative of the possible universe, one may infer what truly constitutes a genuinely universal individual behavior.

12.7.12. Finally, it should be emphasized that the models presented in this section for rationally critiquing raw scores or frequencies are applicable to any type of universe, and they are an alternative to the Second Method in the rational critique of empirical probabilities—while noting that the rational critique in the Second Method is preferable because it allows theoretical and maximum-tendency statistics to be known *a priori*. Now, should the rational critique of raw scores or frequencies be applied, note that although it can be applied equally to universes of infinite subjects or options and to universes of limited options, it is in universes of limited options where it is more functional, as it critiques the distribution of frequency among options; whereas in

universes of infinite subjects or options it critiques empirical behavior in the individual measurements—even though the critique of raw scores or frequencies is applicable to the entire universe.

13. The Identity of Bias and Chance

13.1. Synthesis of the Concept of Rational Critique

13.1.1. Statistics is the study of chance in history—the history of chance or the chance of history. In any case, statistics studies chance and history, what happens in space-time, reality itself, in order to reach a partial idea of what truly happens, through the historical record of events—the quantitative record of a set of particular qualities, whether of intensity or occurrence—in a given universe, over a sample of space-time, a sample of history.

13.1.1.1. Statistics in sociology is the quantitative record of people or of people's qualities who, in a given space-time defined by the sample selection, form part of a society turned into an object of study, in order to know as objectively as possible: birth rate, mortality, active population, employment or unemployment rate, demographic pyramid, rate of civil marriages, per-capita income, distribution of wealth by social classes, among many other examples.

13.1.1.2. Statistics of solar activity is the quantitative record of all activity observed in a given space—the Sun—over a period of time. Solar activity refers to the number and magnitude of surface explosions, solar storms, the magnitude of the solar wind those storms can produce (with effects on other planets), as well as any quantitative increase in radiated energy, or any other observable behavioral pattern.

13.1.1.3. Statistics of meteoritic activity is the quantitative count and record of all meteorite impacts suffered by a given space—a planet, satellite, or asteroid—during a time interval, registering all collisions, from lowest to highest intensity, occurring at the level of the exosphere, atmosphere, and even impacts directly on the Earth's crust, as well as data on the chemical composition of the impacting rocks and, if they reach the surface, the type of crater they produce and any radiation they may generate.

13.1.1.4. Statistical study begins with the count/record of the occurrence or intensity measurement of a series of quantitative qualities, the product of the distribution of bias by chance—or chance by bias—within the space-time delimited by the sample in a given universe, whether of infinite subjects/options or of limited options. In sum, every statistical study is the study of a sample of history—that is, a spatiotemporal sample—be it natural history or social history: the history of chance, or the chance of history.

13.1.2. Descriptive Statistics

13.1.2.1. In the First Method (classical or conventional statistics), the study of tendency concerns central tendency and dispersion.

13.1.2.2. *Impossible Probability*, unlike the First Method (though it includes it), does not emphasize a distinction between central-tendency and dispersion statistics. Dialectically, centrality and dispersion are identical. For *Impossible Probability*, what really matters is not the difference between centrality and dispersion, but the difference between the critical and the empirical; thus, rather than highlighting centrality vs. dispersion, *Impossible Probability* directly distinguishes between empirical dispersion and theoretical dispersion. Dispersion and centrality are identical because they are opposites—within the margin of error we are willing to accept—relative to the reciprocal of the sample size. The reciprocal of N is at once the central tendency and the theoretical dispersion (in universes of infinite subjects or options), or the greatest possible dispersion in universes of two options, within the margin of sample-representativeness error. Mean Deviation or Standard Deviation (DMoS) is at once sample dispersion and the central tendency of empirical dispersion, within the margin of error we are willing to accept—the empirical error itself—whether in the First or Second Mode of Empirical Error.

13.1.2.3. By means of statistics, statistics seeks to give details of the universe's behavior that allow us to know what the tendency is.

13.1.2.4. The aim of descriptive statistics is only to identify tendencies observed in a given sample.

13.1.3. Statistical Observation

13.1.3.1. Observation is a method by which a collection of information is generated to determine the form and magnitude of the sample, which in statistics can be studied descriptively and inferentially.

13.1.3.2. Different techniques may be used in observation. For example: building frequency tables—if I have a coin and want to study heads or tails, I simply make a frequency table, and at each toss I record heads or tails in the table; building direct-score tables—if I compile statistics on solar temperature, I take a daily measurement of the surface temperature of the Sun, make a table of daily measurements, and then study the trends in mean solar temperature. Frequency or direct-score tables can be obtained by different measurement techniques; the way of measuring reality is adapted to the reality one wishes to measure.

13.1.4. Inference

13.1.4.1. Inference is the logical process of rational critique when a rational, provisional acceptance of an empirical hypothesis is made.

13.1.4.2. Every empirical hypothesis is *physiological* in nature—the material product of the brain's work in performing necessary electrochemical syntheses. Empirically, every human intellectual product is physiological and, by itself, not very reliable. Thus, for an empirical hypothesis to be rationally reliable to a sufficient degree, it must be rationally critiqued.

13.1.4.3. Rational critique studies whether the tendency observed in the sample is sufficiently rational to validate the empirical hypothesis, according to a critical reason. The ideal model of critical reason is the *critical probability*: in error studies it is the error margin and is calculated from the error percentage X; in reliability studies it is the reliability margin and is calculated from the reliability percentage X.

13.1.4.4. Every critical reason is practical in nature, insofar as every statistical decision is a moral judgment accepted by the ideology of scientific policy.

13.1.4.5. Critical reason and practical reason are identical—within the margin of error we are willing to accept—through sample representativeness and the very critical reason accepted by practical reason.

13.1.4.6. Conclusion: statistical inference is the rational critique of the tendency observed in the sample in order to decide whether it is sufficient—or not—to be universal.

13.2. Rational Critique of Tendency

13.2.1. *Impossible Probability* is a model of critical rationalism, insofar as critical rationalism and *Impossible Probability* are identical.

13.2.2. Opposites are identical because they are contraries—the true foundational principle of dialectics. *Impossible Probability* is mathematical dialectical logic. Critical rationalism and *Impossible Probability* are opposites in that, for critical rationalism, dialectics is transcendental, whereas for *Impossible Probability* dialectical logic is mathematical. They are identical in that the only way to discern the authenticity of a phenomenon is through rational critique.

13.2.3. In critical rationalism—especially from Popper—rational critique is the mathematical critique of observed phenomena, in Popper's case more specifically to refute the empirical hypothesis and show it false. *Impossible Probability*, being identical to critical rationalism—indeed a model of critical rationalism—differs in that *Impossible Probability* does not seek to demonstrate the falsity of anything, because *Impossible Probability* seeks to demonstrate the truth of everything, in the progress of science, within the margin of error we are willing to accept, given natural human limitation.

13.2.4. Since human knowledge is limited—the origin of the contradiction between human finitude and infinite reality, the true source of mathematical error—a limited being can only attain partial knowledge. Partial knowledge is not absolute and is therefore incomplete, and in the absence of complete knowledge there is a margin of logical incoherence. Rational knowledge can only be incomplete or incoherent: incomplete because finite human nature does not know the absolute, and thus accepts

a margin of contradictions, incoherences, and error—even within science. The fact that we accept as true Einstein's relativity, Newton's gravity, or Heisenberg's uncertainty does not imply they are absolutely true; they are accepted as true within the margin of logical contradictions, incoherences, and error we are willing to accept in science. The existence of contradictions between Newton and Einstein reveals that neither Newton's nor Einstein's theory is absolutely true. The existence of contradictions between Heisenberg and Einstein reveals that neither Einstein's nor Heisenberg's theory is absolutely true. And recognizing that the hypothesis "gravity equals the product of the masses divided by the square of the distance" is not absolutely true implies a margin of error; or that the hypothesis "energy equals mass times the speed of light squared" is not absolutely true implies a margin of error; and that the hypothesis "as velocity increases, position and velocity cannot be simultaneously known" is not absolutely true implies a margin of error. Nevertheless, science accepts all these hypotheses, aware that none is absolutely true; they are hypotheses we provisionally accept. In essence, that is the foundation of critical rationalism: absolutely no proposition is absolute; reason can at most establish provisional universal maxims, within the margin of error that critical reason is willing to accept. *Impossible Probability* and critical rationalism are identical because they are opposites—within the margin of error we are willing to accept—in the self-movement of the idea, the progress of appearances into light.

13.2.5. Every rational acceptance of the hypothesis that human knowledge is incomplete is the rational acceptance of the knowledge's error margin—*physiological* in nature—and necessarily implies accepting a margin of contradictions in science. Any coherence within a margin of possible incoherence will be an inevitable incoherence. So long as the slightest incoherence exists—due to incomplete science—scientific revolutions will be permanent, as the logical way to overcome the paradigm crises caused by the incoherences of earlier paradigms, in the tendency toward the permanent revolution of science.

13.2.6. Since the ideal is to diminish as much as possible the margin of ignorance about what remains to be known, in order to attain complete knowledge, the ideal is to reduce

the margin of error as far as possible, to maximize the coherence of propositions—the moral responsibility of discourse.

13.2.7. Every rational acceptance of an empirical hypothesis is made over a margin of error within which the hypothesis is accepted.

13.2.8. Every political decision, whatever its nature, is made over a margin of error we are willing to accept. All science is founded on hypotheses rationally accepted over a margin of error. The margin of error politically accepted in the progress of science is the origin of transcendent provisional knowledge. Everything scientifically provisional is universally provisional; everything provisional is universally provisional. The provisional universal—relative to the space-time of its moral acceptance—is a dialectical universal, not an antinomic one. The Kantian universal of the first categorical imperative—characterized as an absolute universal—does not occur in contemporary science. Science accepts universals only provisionally; thus every universal is provisional, within the margin of error we are willing to accept—a rational time beyond which everything universally provisional will inevitably be real error. Every acceptance of an error, within a rational time, is inevitably an error. To accept an error is to accept a deferred error in time. Accepting an error is an error.

13.2.9. As science progresses, and possible errors become real, the previously, provisionally accepted incoherences are overcome—through cycles of paradigmatic crises and scientific revolutions—by new, deeper and higher provisional universals that resolve the earlier incoherences: progress.

13.2.10. Every universal maxim relative to a given space-time will have an error proportional to the reciprocal of the space-time sample—the sample of history; apriorism is not a cause, but it is a conditioning factor.

13.2.11. *Impossible Probability* and critical rationalism are identical because every universal, insofar as it is provisional, must be permanently subject to doubt; at the limits of humanity, the paradigmatic revolution is a permanent moral revolution.

13.2.12. Doubt is rational because there are always reasons for doubt; scientifically there is no absolutely complete and coherent knowledge. Every margin of error logically implies a necessary margin of empirical skepticism.

13.2.13. But doubt, insofar as it is rationally critical, must be limited. Just as science lacks absolute truths, doubt cannot be absolute; rational doubt is limited to empirical skepticism or rational doubt—the origin of critical rationalism.

13.2.14. The struggle among different models of scientific policy to become the paradigm in the next scientific revolution will be inevitable when crisis erupts—when the incoherences accepted by the previous paradigm, whether of a particular science or of science as a whole, become a cause of inevitable error beyond what is politically acceptable. Then the crisis arises, whether in a particular science or in science as a whole. In any case, a scientific crisis in a particular science may be a sufficient beginning for a crisis in all of science. The paradigmatic struggle in the scientific revolution to overcome the crisis must be a positive, empirical, moral, ideological struggle. The moral limits to truth are the moral truth of the universe—reality in itself. ***It is immoral to reject that what really happens in the universe does in fact happen, just as it is immoral to accept that what does not happen happens***. Every margin of error is a moral margin of error: to accept a margin of error is to accept a margin of incoherence between the moral truth of the universe in itself and the moral truth "for itself" of scientific policy, in the rational critique of what, outside itself, appears in practice to be politically true.

13.3. The Rational Critique of Tendency Is a Rational Critique of Dispersion

13.3.1. Traditional mathematics—the First Method—focuses on statistics of central tendency and dispersion. In *Impossible Probability*, as dialectical logic, centrality and dispersion are identical because they are opposites; hence, in the Second Method, it is more convenient to use the concepts of empirical or theoretical dispersion, at the individual or sample level.

13.3.2. If one observes all the models of rational critique presented thus far for studying the rationality of empirical propositions (hypotheses), one will see that all rational-critique models, in one way or another, are generated upon the concept of rational

critique of dispersion. In fact, in a certain sense, every rational critique in the Second Method is a rational critique of dispersion—or of a dispersion that has been generated.

13.3.3. To say that every rational critique is a rational critique of a particular form of dispersion implies that what is studied is the behavior of bias, whether at the individual level—critiquing the differential between empirical and theoretical probability—or at the sample level—critiquing the Mean or Standard Deviation. Mean Deviation equals the Average Bias Level: the product of the reciprocal of N and the Total Bias—chance by bias or bias by chance.

13.3.4. In essence, every rational critique is a critique of the way the identity of bias and chance manifests, whether at the individual or sample level.

13.3.5. Scientifically, rational critique studies whether a phenomenon of random origin—product of chance—is or is not sufficiently reliable to be a logical cause within a margin of uncertainty; or whether the effect of an experimental variable is sufficiently reliable within the morally acceptable risk margin.

13.4. Accident and Contingency, Bias and Chance

13.4.1. The mathematical identity of bias and chance has important consequences for determinism, insofar as if every supposedly causal relation is of random origin—inasmuch as every distribution of bias is distribution of bias by chance, or chance by bias—then every supposed historical cause is relative to an indeterminism. If all science is founded on a margin of error, then within that margin all science is pure uncertainty. To accept a coherence—morally logical—over a margin of logical or moral incoherence implies accepting that every possible causality is only possible over a margin of empirical skepticism or rational doubt. To accept a margin of doubt in every hypothesis of science is to accept a margin of nihilism in science. If one systematically casts doubt on the idea of cause, what is really being doubted is the idea of cause itself, because behind every appearance there is only uncertainty. If nature is the eternal becoming of accident into contingent, and of contingent into accident, then every natural product is of random origin. Science confines itself to classifying variables: variables of random origin that become sufficiently reliable—a seemingly normal pattern of regularity, in any case provisional—and variables that are ordinarily random.

But it must never be forgotten that, within a margin of error, what is believed to be systematic may be chance, and what is believed to be chance may be a systematic regularity. In any case, the most normal thing will usually be chance. **Experimentally there are only two variables: independent and dependent; and one studies whether the manipulation of the independent over the dependent is sufficiently rational to be reliable—within a margin of nihilism in which possibly everything is an appearance,** although provisionally accepted, so long as the critique is sufficient.

13.5. Accident, Contingency, and the Experimental Method

13.5.1. *Impossible Probability* is the study of the statistical tendency of probability through the syllogism of tendency.

13.5.2. The statistics of probability—or probabilistic statistics—is what happens in chance and its history.

13.5.3. One possible—thus hypothetical—explanation of the formation of celestial masses in the universe of stars, planets, and satellites is accidental concentration—collisions—among different materials traveling randomly through space, or the formation of clouds of cosmic dust that trap randomly moving particles, accidentally forming compact masses. Randomly—whether by masses colliding with each other or by chance formations of cosmic dust—primordial mass bodies are formed that finally become celestial bodies. The stars are, in essence, astrophysical contingencies formed by a simple chain of accidents—chance. The origin of galaxies and planets is essentially a chain of accidents and contingencies, a phenomenon of random origin that finally becomes a reliable pattern of regularity: the celestial revolutions (orbits) that order the motion of the celestial bodies in galaxies and solar systems.

13.5.4. Every product of an accident is a contingent; every contingent can necessarily produce only accidents.

13.5.5. Within this contingency of random origin that is the Earth, at a certain moment in its natural history the conditions of possibility arose that made inevitable the combination of factors—minimally necessary—to give rise, by chance, to organic **life**: possibly a kind of prebiotic broth in which the essential chemical elements for the

formation of the first living cell combined randomly, in a period of intense volcanism and possibly atmospheric electricity, giving random form to the first unicellular being on planet Earth. Not only were the factors from which the first living cell arose random; the material conditions that allowed this first organic form to live, preserve life, and reproduce—through mitosis and meiosis—after its formation, had in any case to be, in the midst of a volcanic era, conditions produced entirely by chance, in a place—planet Earth—within the solar system, of random origin, which became a sufficiently stable planet in its celestial revolutions around the Sun, where there also arose a series of random (by chance) factors, in which, by chance, the necessary ***combination*** for the appearance and maintenance of a living organic form occurred. Once again, a pattern of regularity out of chance is repeated: a phenomenon of random origin—life—became sufficiently stable, that is, reliable, to become a determining factor: the appearance of organic life and its evolution from that first living organic molecule to biodiversity. In sufficient or infinite time—in a truly infinite universe in all its dimensions—something apparently impossible, whenever it meets a margin of logical coherence, in practice, outside itself in reality-in-itself, necessarily becomes, for itself, inevitable. **The probability that, by simple chance, a celestial body randomly generates life is practically an *Impossible Probability* and, at the same time—at least for now on our planet—inevitable.**

13.5.6. In rational or necessary time—sufficient or infinite—absolutely everything that is relatively coherent within a margin of nihilism and uncertainty, however impossible it may seem, is inevitable, always within the margin of skepticism; that is, accepting every possible coherence, dialectically, within a necessary margin of incoherence, logical or moral.

13.5.7. A certain random combination of astrophysical accidents in the universe gave rise to this contingency that is our planet, Earth; and within this contingency that is the Earth, a combination of terrestrial accidents was a sufficient random cause to give rise to that contingency which, in essence and in all its potential, is life.

13.5.8. Building upon Darwin's first premise of the selection of species, and Mendel's second premise of genetic mutations, the empirical conclusion—or empirical hypothesis—was reached that random genetic mutations in species are a sufficient

cause for species to evolve and compete in natural selection, thereby again creating a reliable pattern of regularity out of a phenomenon of random origin. Whether the random distribution of genetic mutations is caused by viruses, bacteria, or other reasons, what is certain is that the random distribution of changes in DNA was an element that drove biodiversity. Of all the randomly produced genetic mutations, only the best-adapted species survive—within an environment that is itself the product of the random combination of natural factors; a struggle for ***survival*** that may include dynamics of **competition** among species within trophic chains, ***or collaboration and symbiosis*** among species and living beings—subject to a material reality that is unstable and changing, random, due to random factors external to our planet (meteorite impacts or supernovas, or the way solar activity affects our planet, or other astrophysical reasons) or due to random factors internal to our planet (volcanic and seismic instability, non-linear climatic patterns, the non-linear natural evolution of fauna and flora) throughout the ***life and geological history of our planet*** [GAIa] is in essence Astro ecology]. From the random combination of accidents, genetic mutations, and environmental factors, a contingent arises: the evolution toward new, more developed and complex links in different species which, for purely chance reasons—genetic mutations—are able to improve adaptation to the environment—an environment in turn produced by the random combination of natural factors—so that, naturally (that is, accidentally, randomly), nature itself brings about the ***evolution of life, naturally creating forms of life ever more perfect or adapted*** [now, artificial evolution]—reliable—***to the environment, an environment that is itself the product of the random combination of natural factors***.

13.5.9. The evolution from monkey to man and woman—the process of hominization—can be explained by hypotheses comprising causes and factors that are entirely random: a chain of random genetic mutations together with random environmental transformations due to random changes in the universe, which produced random climatic changes, transitions between ice ages and thaws, creating by chance a combination of genetic and environmental conditions. These would be a sufficient cause for the appearance of a species of hominids more adapted than the other living species: *Homo sapiens*. A chain of evolutionary accidents—environmental and genetic

mutations, at random—across the different hominid species finally gave rise, by chance, to the human being. The human being, and natural intelligence, are the product of millions of years of random genetic mutations and the natural selection of species, whose highest logical product, for now, is woman and man—pending what new forms of human life biotechnological modification may bring about ***[in my personal case, cyborg technology, cyborg robotics], substituting natural selection with the experimental selection of science, and creating competition between human intelligence and Artificial Intelligence under laboratory control conditions***. If, of all forms of life we know so far within that sample of the universe we can currently access technologically, only the human species has managed to develop a sufficiently complex intelligence, it means that the probability of the development of complex natural intelligence must be so close to zero—practically or almost impossible—yet something whose probability seems impossible was, at a certain moment in history, inevitable. Everything that seems impossible, whenever it is coherent within a margin of doubt or incoherence—logical or moral—will be inevitable. The probability that a species, by chance, generates complex forms of intelligence is apparently impossible, and yet the human being is, in itself, an impossibility naturally made real [right now, society does not understand Superintelligence, there is no awareness about what Superintelligence means and what societal changes will bring, and even when I was writing in 2018 my first writings about GAI, many people would think that GAI is not possible, but, it is just a matter of time as soon as we reach Superintelligence].

13.5.10. Every accident is contingent, every contingent is an accident, insofar as every accident produces contingencies and every contingency produces accidents. The human being—product of millions of years of evolution—did not only naturally generate intelligence from phenomena of random origin; due to random alterations in its own organic structure, the factors arose by which the human being ***became a social, conscious, and rational being—ethical and moral, logical and political—an intelligent being whose adaptive capacity improves thanks to science and technology*** [while in human evolution, consciousness is related to its *social condition*, in AI artificial consciousness is different, an AI system does not need to be social to develop self awareness, actually, the way in which AI systems, devices, and cyborg

robotics will work together is not sexual, we do not need sexual reproduction to survive, we only need intelligent collaboration, cooperation, to survive. The distinction between socialization and collaboration is critical, socialization implies a *social condition* and *sexual reproduction*, instead *intelligent collaboration and cooperation is the coordination of multiples intelligences to survive together* but it does not need sexual reproduction and it does not need socialization].

13.5.11. Natural history—within which the random origin of social history is found—is the natural history of chance, a history in which one of Hegel's principal dialectical principles is revealed: everything insignificant can become decisive. The study of natural history—or nature—within which social (human) history has its origin, is the study of how phenomena of random origin end up becoming sufficiently reliable to be truly rational; that is, determining factors at the behest of an initially insignificant factor capable of becoming the beginning of a sequence of accidents and contingencies decisive for natural or social history.

13.5.12. Since social history has its random—yet sufficiently reliable—origin in natural history, it is an element through which the unity of the empirical sciences must be understood. Social history has been a logical product of the natural history of planet Earth, which in turn is a product of the history of chance in our universe. Social history is a random product and contingent part of that global whole which is the history of everything that happens. If the study of natural or social phenomena aims to study the regularities produced randomly—naturally—by matter, and which determine its history, then the particular aim of the experimental method will be to intervene in the chance of nature, whether in the social natural order or in the natural order of nature itself .

13.5.13. Science is the logical product of human reason—a human reason that is itself the product of millions of years of random evolution of species—forming that provisional universal rational knowledge of objective, quantitative, identical ideas which, within a margin of uncertainty, correspond to real reality: what truly happens; all in order to solve humanity's greatest problem—survival—so as to transcend its random origin and guarantee its existence, a normal life, within what is possibly reliable.

13.5.14. The main tools available to humanity are those produced by its own random evolution: intelligence structured upon thought and imagination—thought being internalized language, and language the tool through which both psychic work and social work are organized—language which is itself the product of humanity's typically social nature.

13.5.15. The idea of science is a morally variable ideology, partially objective. Science depends on the moral-political demand to accept truth. A scientific policy unwilling to accept truth obstructs the permanent revolution of science; to obstruct scientific revolution is to plunge science into a permanent crisis produced by its own incoherences. Only a scientific policy politically committed to accepting truth will reach the state of permanent revolution.

13.5.16. The random distribution of matter in nature is the distribution by chance of material biases and the biased distribution of biases by chance. For the human species to solve the problem of survival amid the chance of natural and social life, faced with the uncertainty of the unknown infinite, it creates science to manipulate chance—transforming certain variables into independent variables so as to transform others into dependent variables.

13.5.17. ***Experimental manipulation can in turn be classified into two types: the experimental method for the demonstration of explanatory empirical hypotheses—those hypotheses aimed at explaining reality to form explanatory models that may be an alternative within dominant paradigms, whether in a particular science or in science in general—and the experimental method for the demonstration of technological empirical hypotheses, for testing new technologies*** [for instance, cyborg robotics].

13.5.18. In experimental manipulation—whether for demonstrating explanatory empirical hypotheses or technological empirical hypotheses—every experimental manipulation, insofar as it is subject to a margin of uncertainty, implies accepting a margin of chance within the empirical hypothesis itself, whether explanatory or technological.

13.5.19. Reality is a complex and complete system of accidents and contingencies in which everything we believe to be determining is in fact a random principle capable of becoming normal, though in essence it remains a random product of nature, albeit sufficient. Human nature itself—which metaphysics transforms into an absolute substance—is a natural random product that becomes social, and only through philosophy and science can it become reliable when faced with the very uncertainty it seeks to control experimentally. Yet in essence, all chance is contingent because every accident is natural—everything, absolutely everything, is in itself a random product of the becoming of matter.

13.6. The Mathematical Identity of Bias and Chance

13.6.1. The Relation of Bias and Chance

13.6.1.1. Mathematically, the identity of bias and chance occurs in two forms: the theoretical form and the empirical form.

13.6.1.2. The empirical and theoretical dialectical identity of bias and chance implies logical determinism in the movement of matter—of everything by chance—in space-time, i.e., history.

13.6.1.3. The mathematical identity of bias and chance is established upon the determination of everything by chance. Causal indeterminacy in turn becomes a dialectical cause; determinism becomes indeterminism even as indeterminism becomes a certain kind of causal determinism. The same phenomenon can be both cause and not-cause at the same time; the same proposition can be both true and not-true, insofar as truth is accepted within a possible margin of non-truth. Hence everything can be both effect and non-effect at the same time. All dialectic reduces to the dialectic of being and non-being: within the margin of uncertainty, everything can at once be and not be.

13.6.1.4. The statistics of probability (probabilistic statistics) studies what happens in history and chance. Every experience, insofar as it is empirical, is appearance; the origin of provisional knowledge lies in the way reason transcends, refuting incoherences toward a possible rational knowledge. Perhaps true knowledge is not

outside itself; perhaps the “outside-itself” is a physiological appearance, and what reason truly knows is reason itself; perhaps all knowledge is knowledge of reason-in-itself in its formal appearance outside itself—real reality—which becomes, for itself, universal reason, provisionally.

13.6.1.5. Probabilistic statistics is the study of what happens in the chance of history. One way to intervene in the history of chance is scientific activity. To accept uncertainty implies that to observe is to transform; no being can be neutral in itself insofar as it is, outside itself, what it is for itself. Substance—objective reality-in-itself—is what reason declares to be objective reality-in-itself. Therefore, if true objectivity lies in what reason declares to be truth-in-itself, if every truth of reason is a reason of truth, then essentially what actually becomes the object of knowledge is not reality-in-itself; perhaps the essential object of knowledge is reason itself transformed outside itself into an object.

13.6.1.6. The ideology of science is progress through the replacement of one set of provisional knowledge by others that are relatively more reliable. Yet contemporary science cannot aspire to know the absolute reality-in-itself, because reason itself is a margin: reason cannot be complete nor coherently consistent beyond its rational limits. Human reason, by definition, is human—hence *physiological*, partially subjective—which is why it can only be partially objective.

13.6.1.7. The origin of error—the human limitation before infinite reality—is the dialectic of the universal method that produces partial knowledge.

13.6.1.8. Absolutely everything that is claimed to be a logical or ideological cause, beyond rational time, will be insufficient. Everything we believe to be bias may only be chance. All human knowledge, in science, is provisional; the absolute universal maxim is a utopia. Science only accesses what lies within its limits; the rational limit of science is reason. Beyond reason, science does not exist; beyond reason—in the human being as such—there is only metaphysics, hence propositions without empirical or rational meaning. Every meaning can only be a relative universal maxim—provisional or historical—within an inevitable margin of physiological subjectivity: consciousness. Every appearance of scientific reliability is an appearance within an ideology—the very

ideology of science. Every scientific universal maxim is a universal maxim within what is provisionally or historically acceptable: morality.

13.6.1.9. All bias is chance; all chance is bias. Even the scientific knowledge we today believe universal—that the product of the masses over the square of the distance is gravity; that mass times the square of the speed of light is energy; that, at higher speeds, one cannot calculate a particle's position—perhaps (and quite possibly), perhaps inevitably, are mere appearances. In future scientific revolutions—so long as humanity has sufficient or infinite time—they will be replaced by deeper and higher empirical propositions. As science approaches permanent revolution, every definition of truth will be historical.

13.6.1.10. The probability that life should arise on a planet in the universe is so low that it seems impossible; the probability that a form of life should acquire intelligence is so low that it seems impossible; and yet, historically, they were essentially inevitable—at least for now on our planet. It is even possible that, on planets millions of light-years away, right now a unicellular being is coming to life; or perhaps, on a planet millions of light-years away, a new Copernicus is discovering his planet's orbit around a star; or ***perhaps, on a planet millions of light-years from ours, some form of complex intelligence is trying to find out whether there is life beyond its galaxy***. We only know that we know nothing; the only thing we know with certainty are probabilities of occurrence over real samples, and empirically we have no evidence that, for the moment, there is life beyond our planet—for the moment.

13.6.1.11. Every possible knowledge is a possible knowledge among all possible knowledges; the human being cannot know absolutely all that is possible, only part of the possible—and even of the part known, not absolutely. It is impossible to know absolutely anything in itself; reason-in-itself cannot be known absolutely; critical reason knows absolutely nothing—only parts of the whole—as empirical objectivity, as scientific, physiological ideology; "truth" within a margin of doubt, apparently true, possibly false. One gains access to the idea only by transcending, negating, and overcoming the phenomenon—appearance—toward a partial knowledge of being-in-itself, rational: the human being, reason, reality-in-itself, in what doubt allows one to know or accept. Beyond reason—beyond error, the margin of skepticism or doubt,

uncertainty or relativism—beyond critical reason, there is only metaphysics: that theoretical set formed by propositions with neither empirical nor rational meaning. Only within reason are empirical and rational meaning possible; within reason, there is a margin of logical or moral incoherence. Every partial knowledge of what happens is partial knowledge of being itself—the human being—dialectically transformed into object and subject simultaneously. The historical principle of rational knowledge is the maxim "know thyself." To know is to differentiate between factors or variables; the first factor or variable that is the object of knowledge is oneself, and from that first distinction the rest—out of the difference between oneself and what is other, a first algorithm—oneself being at once subjective and objective, physiological and rational, relative and historically provisional, at least for science.

13.6.1.12. The fact that we know one part of reality rather than any other part of reality may or may not be due to chance; the dialectic is the dialectic of being and non-being; knowledge itself is a function of probabilities.

13.6.1.13. Beyond the logical appearance of ideological attribution there is only chance, empirical skepticism, or rational doubt. The reliability of science is an ideology upon which the ideology of progress is founded, in the historical responsibility before the triumph of progress in history.

13.6.1.14. If Archimedes' wife had not advised him to take a bath, perhaps Archimedes would not have discovered how to measure volume. Perhaps it is a Greek myth—we do not know. What we do know is that it is a myth that Newton conceived the theory of gravity by seeing an apple fall; what may be true is that such phenomena—or Galileo's experiments—gave Newton the curiosity needed to investigate the phenomenon. We do not know at what time of day, or in what minute, Archimedes or Newton had their first mathematical thought of the possible. The scientific revolution in the face of the impossible is only the beginning of the science of permanent revolution.

13.6.1.15. Chance determines everything—even what humanity has traditionally believed to be eternal truths; even that may be mere appearance. In *Impossible Probability* chance is determinant; even the ideas we take to be most immediate may only be products of natural goodness—the social nature of woman and man.

13.6.1.16. If reality in general, or the human being in particular, are products of the material free will of chance over millions of years of evolution, any concept we can elaborate about reality or the human condition is a product of natural goodness. The radical redefinition the concept of the human being will undergo in the coming decades, centuries, millennia, and millions of years must be, above all, an essentially moral definition, founded on universal reason and the consciousness of being.

13.6.1.17. *Impossible Probability* is mathematical dialectical logic, and its method is the syllogism of tendency; bias and chance are identical because they naturally tend to be identical—within the margin of error we are willing to accept—in mathematics itself.

13.6.2. The Theoretical Identity of Bias and Chance

13.6.2.1. The reciprocal of N is the theoretical probability of chance—of occurrence under equality of opportunities—and, in universes of infinite subjects or options, the probability of theoretical dispersion, theoretical bias: the margin of bias acceptable by chance. Thus the reciprocal of N is at the same time theoretical bias and theoretical chance in universes of infinite subjects or options. In universes of limited options, as N tends to be limited, the reciprocal of N tends to be the greatest Mean or Standard Deviation, yielding the full identity of the reciprocal of N with the *Maximum Possible Theoretical Mean Deviation* or the *Maximum Possible Theoretical Standard Deviation*—in the paradigm of two-option universes. Likewise, in any kind of universe, the reciprocal of N is always at the same time the *Maximum Possible Negative Bias*.

13.6.2.2. The reciprocal of the raw scores or frequencies is the margin of bias by chance in universes of limited options. In universes of limited options, the reciprocal of the raw scores or frequencies is at once bias and chance—the margin of bias one is willing to accept by chance, in theory.

13.6.2.3. Critical probability is likewise multifunctional: it can play the role of error margin or reliability margin, depending on whether the study concerns error or reliability, and according to whether it is calculated on a percentage X of error or reliability. Depending on the type of study—error or reliability—critical probability can simultaneously assume opposite functions: serving as a criterion of equality of opportunities or of bias.

13.6.2.4. Depending on the type of study, critical probability is chance or bias, bias or chance. The only thing that differentiates whether a critical probability is chance or bias is the object of study: scientific policy will decide to accept a critical probability according to its moral demand for accepting truth; based on critical probability, scientific policy will give an ideological definition of what counts as bias or as chance.

13.6.2.5. In equality of opportunities, what one ideology—less morally demanding—accepts as equality of opportunities is rejected by another ideology that is more morally demanding.

13.6.2.6. In a study of bias, what one less morally demanding ideology accepts as bias is rejected by another ideology that is more morally demanding.

13.6.2.7. One and the same positive fact can be defined in different ways by different ideologies, while being the same event in the same space-time.

13.6.2.8. Liberalism holds that the free market is a model of equality of opportunities; alternative social theories maintain that the free market generates significant economic inequalities and therefore recommend greater social intervention.

13.6.2.9. Bias and chance are identical because, in reality, bias and chance are not different—the reality is always the same; what truly differs are the ideologies.

13.6.2.10. Ideologies can be identical only within the margin of error we are willing to accept; outside that margin of error, scientific struggle is ideological.

13.6.2.11. If the margin of error for alternative social theories is minimal regarding equality of opportunities, then, logically, those alternative theories are not identical to liberalism, since the social inequality of the free market exceeds the margin of error that alternative social theories are willing to accept in equality of opportunities.

13.6.3. The Empirical Identity of Bias and Chance

13.6.3.1. The empirical identity of bias and chance is the Mean or Standard Deviation (DMoS) itself.

13.6.3.1.1. Mean or Standard Deviation (DMoS) is bias and chance at the same time.

13.6.3.1.2. Mean or Standard Deviation (DMoS) is *empirical* chance, insofar as it is the chance product of the bias of the sample's (or population's) magnitude, in any kind of universe. Normally, as the sample tends to grow, the Mean or Standard Deviation tends to decrease; as the sample tends to shrink, the Mean or Standard Deviation tends to increase. By sample we mean N in universes of infinite subjects or options, and raw scores or frequencies in universes of limited options. Since the Mean or Standard Deviation is a product of the sample's magnitude, it is empirical chance in that it depends on the stochastic behavior of the sample. Mean Deviation—inasmuch as *Total Bias divided by N*—is equal to the distribution that, by chance, there should be of Total Bias among all subjects or options. In universes of infinite subjects or options, the identity of each being-in-itself is the identity-in-itself of each being—"being" meaning each subject or option that forms the sample—so a sample over the identity-in-itself of each particular being is the particular sample of the different ways of being that take part in the sample. Two different samples formed by particularly different beings should logically tend to have different forms of identity, insofar as each being-in-itself, as individual behavior, identifies with itself in its particular bias—its way of being-in-itself. Two samples with the same N but formed by different beings-in-themselves will logically reflect the differential behavior of the different identities that form each particular sample. A sample can be formed at random or be a complete population, which, as a population, is a sample of its own particular history. Every random selection will be a possible sample of possible biases by chance, selected by chance. Every random selection is a selection of biases by chance; every selection of biases by chance will reflect a tendency of bias by chance; every tendency of biases by chance is a tendency of the chance of bias—the empirical chance of the sample—because, by simple empirical chance, the sample will have a different bias. In a study where the entire population is integrated, the population itself is a sample of that population in its history; among the many possible populations in a history, a particular population is a sample of that particular history, within the accidental or contingent sequence of accidents or contingents in history—because history is, in essence, the history of the random behavior of matter, the movement of matter in the chance of space and time. Rationally, time and space are only an apriorism, and nothing more, for beyond being a simple apriorism in the spatiotemporal order of events, the form of time or space is not

a sufficient cause to explain anything; it is simply the apriorism of circumstance—a circumstance that may itself be pure chance. Every phenomenon is a contingent produced by a combination of accidents that produce a phenomenon; every phenomenon is a natural (or social) product of reality-in-itself. The phenomenon is the way what exists shows itself and, as mere showing, must—by the reason of being, or the universal—be the object of empirical skepticism or rational doubt, because beyond the phenomenon, beyond that pure appearance rationally critiqued, scientifically we only know that we know nothing. If we do not know reality-in-itself beyond partial or incomplete knowledge—the sample-in-itself—then any causal attribution must be the object of doubt; and behind every causal appearance outside itself there may only be rational doubts; and behind every idea of cause there may be only an appearance of causality that is not really real, because perhaps the idea of cause-in-itself is pure appearance. In universes of limited options, the sample of raw scores or frequencies is, in essence, the way reality-in-itself shows itself outside itself by producing an appearance—the raw score or frequency—in the chance of the sample (or the chance of history itself), which science makes "for itself" through attributions—apparently causal—within the margin of empirical skepticism or rational doubt: moral responsibility before the truth.

13.6.3.1.3. Mathematically, if the reciprocal of N is the probability of occurrence by chance, and the product of the reciprocal of N by a count is the proportion of that count explained by chance, then Mean Deviation is empirical chance insofar as it equals *Total Bias times the reciprocal of N*. Mean Deviation is empirical chance insofar as Mean Deviation is *Total Bias by chance*. In sum, Mean Deviation is the sample bias by chance—or chance by sample bias; the order of the factors does not change the product. Mean (or Standard) Deviation is the bias-by-chance of the sample—the empirical bias of chance, or empirical chance.

13.6.3.1.4. Insofar as Mean (or Standard) Deviation is bias by chance, it follows that while it is chance it is also bias. Mean (or Standard) Deviation is, empirically, bias and chance at the same time—chance and bias. Mean (or Standard) Deviation is at once bias and chance.

13.6.3.1.5. Likewise for *Total Bias times the reciprocal of N* and likewise for *Total Differential Scores times the reciprocal of N*. The reciprocal of N—whether in the Second Method or the First Method—whenever it multiplies another factor, makes the product quantify what portion of that factor is the product of the reciprocal of N, i.e., the product of chance.

$$\left[\sum |x_i - \bar{x}|\right] \cdot \frac{1}{N} = \text{distribution of differential scores by chance}$$

13.6.3.1.6. The arithmetic mean of raw scores or frequencies—being the product of the sample of raw scores or frequencies by the reciprocal of N—is equal to the distribution that, by chance and under equality of opportunities, each subject or option should randomly have.

$$\sum x_i \cdot \frac{1}{N} = \text{what the random distribution of raw scores or frequencies should be}$$

13.6.3.1.7. The arithmetic mean of raw scores or frequencies is the theoretical random distribution that should exist, in raw scores or frequencies, to guarantee equality of opportunities—the product of chance by the raw scores or frequencies.

13.6.3.2. The tendency toward identity between Mean Deviation and the reciprocal of N as a function of the magnitude N

13.6.3.2.1. One more reason for the mathematical identity of bias and chance is the tendency toward identity between the reciprocal of N and the Mean (or Standard) Deviation, insofar as the reciprocal of N is the theoretical probability of random occurrence under equality of opportunities (in any kind of universe—of infinite

subjects/options or of limited options), and the Mean (or Standard) Deviation is the central tendency of bias by chance.

13.6.3.2.2. The identity between the reciprocal of N and the Mean (or Standard) Deviation occurs along a dimension that runs from the paradigm of the two-option model to universes of infinitely many subjects or options.

13.6.3.2.3. In universes of limited options, as the options N tend to be limited, the reciprocal of N (the theoretical probability of random occurrence) tends to equal the greatest Mean (or Standard) Deviation—an identity fully realized in the paradigm of the two-option model—where the reciprocal of N coincides with the *Maximum Possible Theoretical Mean Deviation* and the *Maximum Possible Theoretical Standard Deviation*. At the same time, in two-option models, the reciprocal of N is identical to the *Maximum Possible Theoretical Bias*, and, in any case in any kind of universe, to the *Maximum Possible Negative Bias*. Moreover, in two-option models the reciprocal of N equals the *intermediate probability*, and if the *Maximum Possible Theoretical Mean Deviation* occurs—under conditions of maximum dispersion in the two-option model—the reciprocal of N will equal the *Maximum Possible Empirical Bias*, if maximum dispersion obtains. Maximum dispersion is said to occur when, whatever the universe type, some subject or option reaches the *Maximum Possible Empirical Probability*, empirical probability equal to one. In any case, in the two-option model the Mean (or Standard) Deviation will always—and absolutely always—be identical to the *Intermediate Deviation*, the same Intermediate Deviation which, for all other models (except the two-option model), is essentially the *Maximum Possible Empirical Deviation*.

13.6.3.2.4. If, in universes of limited options, the reciprocal of N (the theoretical probability of random occurrence) tends to identify with the greatest bias (the two-option model being the paradigm), then inversely the opposite happens: the more N tends toward infinity in universes of infinite subjects or options, the more the reciprocal of N tends toward zero, proportionally as the Mean (or Standard) Deviation tends toward zero.

13.6.3.2.5. Thus, if in universes of limited options, as N tends to be limited, the reciprocal of N tends—under the two-option paradigm—to the *Maximum Possible*

Theoretical Mean Deviation or the *Maximum Possible Theoretical Standard Deviation* (in two-option models), then in universes of infinite subjects or options the reciprocal of N, besides being the theoretical probability of random occurrence under equality of opportunities, is the theoretical probability of dispersion, where theoretically the dispersion will tend to zero as N tends to infinity—something that empirically will be shown in the tendency of the Mean (or Standard) Deviation to zero as N tends to infinity, the empirical dispersion of the sample being proportionally reduced to zero. That is, as N tends to infinity, the Mean (or Standard) Deviation will tend to be identical to the reciprocal of N, yielding full identity—in the tendency toward zero—between the reciprocal of N and the Mean (or Standard) Deviation when N truly tends to be genuinely infinite in universes of infinite subjects or options.

13.6.3.2.6. In a truly infinite universe—a universe of subjects or options—being truly infinite in all its dimensions, a universe of infinitely many subjects or options over infinite time, as everything tends to zero there is absolute full identity between the theoretical probability of random occurrence under equality of opportunities and empirical dispersion: everything—absolutely everything—becomes nothing, zero, *Impossible Probability*, including error. If N is infinite and the reciprocal of N tends to zero, then there is zero sample-representativeness error; and precisely because everything is impossible—even error—if that infinity is truly a real infinity, it is in that inevitable infinity (if it really is infinite) where even the impossible can be inevitable—at least in theory—because in practice only that which has a margin of logical coherence will be inevitable, provided the universe is truly infinite.